

the TOOL and MANUFACTURING ENGINEER

SEPTEMBER 1960

turning

AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

NEW

HEALDRILL

*... a high-precision drilling machine
designed for fully automatic
NUMERICAL CONTROL OF ALL FUNCTIONS*

The *completely new* Healdrill offers you, for the first time, a high-precision, heavy-duty layout or production drill that's designed to take full advantage of modern numerical control.

This ruggedly-built machine includes tape control of table positioning, speeds, feed rates, automatic "Z" axis cycle and tool-change indication. When a series of holes of the same size are to be drilled, counter-bored or reamed, the cycle is fully automatic, freeing the operator for other work. At each different hole size the cycle stops automatically and a "tool change required" signal light goes on. After change is made, hole is automatically positioned and drilled at correct feed and speed.

Available with "ACRAMATIC" punched tape control by Cincinnati Milling Machine Co., the Healdrill permits simple, direct programming of all functions — tape reading rate of 1200 lines per minute — full range zero shift on both axes — repeatability of $\pm .0002''$ — accuracy of positioning to $\pm .001''$ — and complete manual control from the console when tape is not used.

SPECIFICATIONS

Table Size	24" x 56"
Longitudinal Table Travel	48"
Transverse Table Travel	20"
Vertical Range	0-30"
Spindle Speed Range	30-1800 rpm in 18 steps
Feed Range002"-.030" per rev. in 8 steps

SHOWN IN ACTION in Booth 924 at
The Machine Tool Exposition. Write to
Heald for additional information.

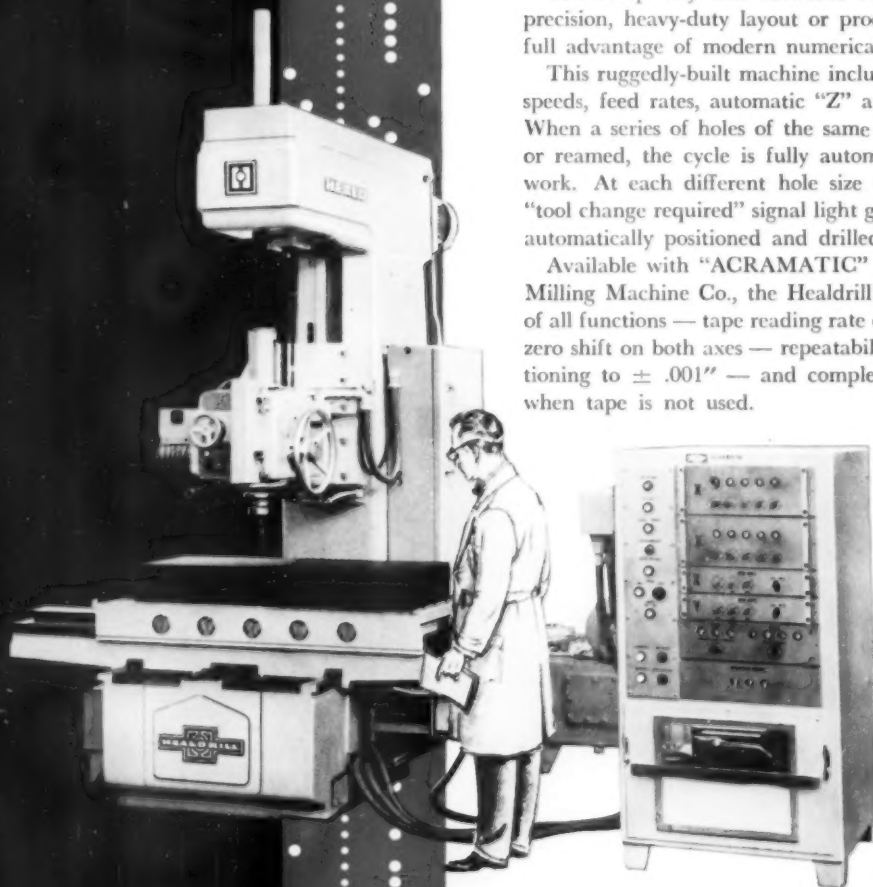
it PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing •
Milwaukee • New York • Philadelphia • Syracuse



the **TOOL** and **MANUFACTURING** **E N G I N E E R**

Volume 45
No. 3

September
1960

PLANNING FOR PRODUCTIVITY *By T. W. Black* 79

By putting modern machine tools to work in his own plant, a machine tool builder has realized outstanding productivity.

Gadgets 87

Finder for fast centering . . . low-cost bending fixture . . . deep-hole drilling fixture . . . driving dog for threaded parts.

PROGRESS IN PRODUCTIVITY—TODAY'S MACHINE TOOLS

More Chips, No Chatter *By John W. Greve* 91

Design improvements, higher horsepower and automatic controls have more than doubled lathe productivity.

More Holes, Fewer Fixtures *By Daniel B. Dallas* 97

Faster, more versatile drilling and boring machines, often numerically controlled, give high output with low tooling cost.

Bigger Cuts, Better Controls *By Robert Heslen* 107

Automatic tool changing and tape control minimize downtime on today's milling machines. Machine output is multiplied.

Faster Metal Removal to Millionths *By Robert Heslen* 112

Newly developed grinding machines control the size of parts they produce within preset limits without operator intervention.

More Punch, Fewer Problems *By Daniel B. Dallas* 119

The newer presses are characterized by greater versatility, better reliability, higher output and improved safety.

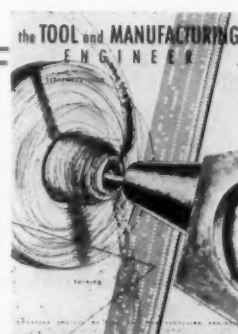
ADVENTURE IN PRODUCTIVITY— AN ADVANCE LOOK AT THE MACHINE TOOL EXPOSITION 127

ASTME IN ACTION—ENGINEERS AS CIVIC LEADERS 175

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THIS MONTH'S COVER

Trends in machine tool design—higher speeds, greater rigidity and tape control—are symbolized in this abstract rendering of a turret lathe boring operation by artist William Solms. Developments in turning are covered in an article beginning on page 91 and modern lathes are one of the many types of equipment covered in the "Adventure in Productivity" section starting on page 127.



THE TOOL AND MANUFACTURING ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index*, used generally in libraries. The magazine is available in microfilm form at a nominal cost.



Thor

Everything you want in **360 CYCLE** Grinders... *and more!*

25% faster metal removal. Compare it with *any* other type grinder.

30% saved on wheel cost. Constant speed gets maximum cutting power from the abrasives.

8% speed loss *under full load*—which saves you...

80% on power cost.

30% is the *minimum* overall saving.

100% best buy in High Frequency Electric Grinders!

Thor's straight or right angle models of 360 Cycle Grinders are available in 21 speeds, from 3700 to 21,600 R.P.M. Thor furnishes complete equipment for demonstrations in your plant. Call your Thor factory representative. Thor Power Tool Co., Aurora, Illinois. Branches in all principal cities.



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Some Things Never Change

This month THE TOOL ENGINEER becomes THE TOOL AND MANUFACTURING ENGINEER. This name ties in more closely with the Society's new name, of course.

But some things never change.

THE TOOL AND MANUFACTURING ENGINEER, like THE TOOL ENGINEER, will devote itself to the advancement of manufacturing. As always, the magazine will concentrate on publishing information that leads to greater manufacturing efficiency. It will be concerned with machines, tools, tooling. Automation, control, precision gaging. Heat treating, plating, painting, finishing, assembly. Manufacturing methods, equipment and processes of all kinds.

As always, the magazine will emphasize manufacturing planning and manufacturing management—serving the needs of tens of thousands of readers who plan production lines and profit patterns.

As always, the magazine will be edited by a staff of experts in the tool and manufacturing engineering field—a staff that is equally expert in all phases of magazine production.

As always, the object of this staff will be to make THE TOOL AND MANUFACTURING ENGINEER a good tool for tool and manufacturing engineers.

As always, the engineering articles will be factual and authoritative. And, as always, they will be clearly written and profusely illustrated so that the information they contain can be easily understood and quickly put to work to improve manufacturing efficiency everywhere.

Yes, some things never change.

THE TOOL AND MANUFACTURING ENGINEER, the magazine that helps 40,000 engineers plan for greater productivity in their own plants, continues the tradition of service to ASTME members and to all of industry.

This issue, with its bonus of worthwhile ideas generated by the Machine Tool Exposition, shows how one magazine can help production engineers bridge the gap between today and tomorrow.

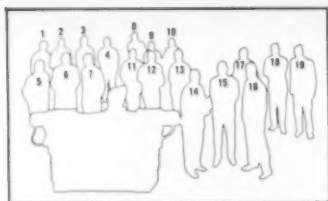
As always, we wish you good and productive reading!

John W. Greve

EDITOR



See You in Chicago!



- 1 C J Hanrahan, asst. supt.
- 2 D A Piper, product engineer
- 3 W Szacik, eng. supervisor
- 4 J N McHoul, sales engineer
- 5 E J Patria, superintendent
- 6 C R Adams, chief sales engineer
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- 18 H M Frechette, v. p. & gen. mgr.
- 19 E J Kingsbury Jr, v. p. & treas.

not shown in photo

N J Stankiewicz, service mgr.
A H Knight, sales engineer
C E Loos, electrical engineer
C O Snow, asst. to the supt.

3 Automatic Indexing Machines Show How to Combine a Variety of Operations

Here in booth 731 of the Amphitheatre is equipment that is unexcelled for high production drilling and tapping work to close tolerances. Here too are attachments for performing a variety of operations in the same chucking of the work.

All of us plan to be here (but don't worry, not all at once). And we want to show you . . .

— 3 automatic indexing machines

— 8 different models of automatic drilling and tapping units

— 11 different head attachments for a variety of operations — boring, milling, recessing, oscillating, angular feed, speeder, planetary speed reducer, etc.

— other accessories — two-position hydraulic slide, coolant distributor, bushing carrier, etc.

Left — a fairly simple setup with 20-inch index table and three auto-

matic drilling and tapping units.

Rear — a large setup with 63-inch index table and a center column that supports ten units. Seven units are mounted on wing bases. Suitable for many operations.

Right — a new basic machine with 40-inch index table and no center column. This new addition fits into our line between the other two types.

These machines have no special tooling, but we will be glad to talk to you about designing, building and tooling a machine all ready to produce for you.

See you in Chicago! Kingsbury Machine Tool Corp., Keene, N. H.

KINGSBURY

Use Reader Service Card, CIRCLE 4

HARDINGE
ELMIRA, N.Y.

STANDARD EQUIPMENT

in

Progressive Screw Machine Plants

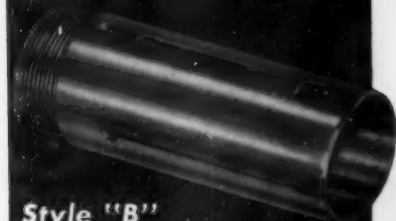
The Only MASTER COLLET
With No Work Pressure on the Screw.



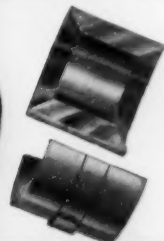
Style "S"
Master Collets and Pads



Pads Interchangeable
Among Different
Makes of Automatics



Style "B"
Master Feed Fingers and Pads



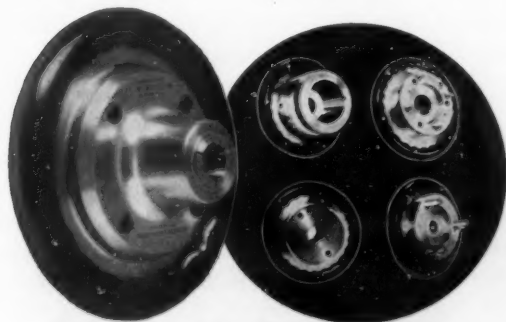
HARDINGE BROTHERS, INC., Elmira, N. Y.

Write for Style "S" Bulletin Style "B" Bulletin

HARDINGE-SJOGREN

Speed COLLET CHUCKS

Fast — Accurate
Increase Production Capacity



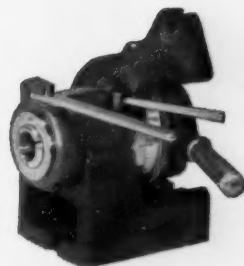
Available in $1\frac{1}{8}$ ", $1\frac{1}{4}$ ", $2\frac{1}{4}$ ", and $3\frac{1}{2}$ " collet capacity.
Threaded nose, cam lock, tapered key-drive and American
Standard spindles. Write for Bulletin 8A.

HARDINGE BROTHERS, INC., Elmira, N. Y.

Immediate stock delivery from Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, New York, Philadelphia, Seattle, Portland, Minneapolis, Oakland, St. Louis, Springfield, N.J., and Toronto.



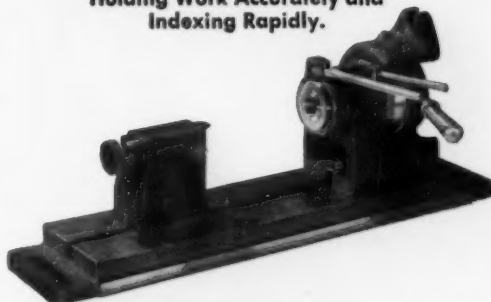
H-4 Tool Room-Inspection



HV-4 Production

HARDINGE COLLET INDEX FIXTURES

Increase Production by
Holding Work Accurately and
Indexing Rapidly.



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Write for Bulletin CFS

HARDINGE
ELMIRA, N.Y.

COLLETS for LATHES and MILLERS



ACCURACY — DURABILITY — LOW COST



Write for Bulletin 56 —
Complete collet ordering



Information for all Lathes, Millers, Grinders and Fixtures

HARDINGE BROTHERS, INC., Elmira, N. Y.

TAPS DIES GAGES

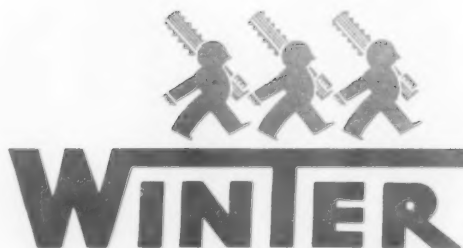
**THE BALANCED LINE
WITH 'BALANCED ACTION'**



Metalworking men throughout industry recognize the precision of Winter Brothers 'Balanced Action' line of taps, dies and gages. From initial material selection to final inspection and packaging all Winter Brothers products are subject to the industry's highest quality control standards . . . a most important factor in determining ultimate on-the-job performance.

Winter Brothers Taps, Dies and Gages are stocked for your convenience by leading industrial distributors across the country. Specify "Winter Brothers" the next time you order.

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Rochester, Michigan, U. S. A.

**DISTRIBUTORS IN PRINCIPAL CITIES. BRANCHES IN NEW YORK
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CARBIDE TIPPED EXPANSION REAMERS

**ARE RIGID,
ACCURATE, ECONOMICAL**



National Expansion Reamers with carbide tips feature solid bodies to provide greater rigidity and accuracy than conventional split-body expansion reamers. Expansion plug contact with the tool body extends well beyond the rear of the tips to assure uniform parallel expansion. Plug-type reamers are easy to adjust to .0001 of an inch. New cutting edges are exposed, clearance is automatically provided. Reamer servicing is virtually eliminated.

Shell Type Expansion Chucking Reamers are designed for low-cost, mass production reaming to close tolerances. They can be easily and accurately expanded to compensate for wear. When completely expanded, economical replacement shells are available from your local National Distributor. Check with National, too, for multi-diameter reamers incorporating expansion-type replacement shells.

"CALL YOUR NATIONAL DISTRIBUTOR"

**DISTRIBUTORS IN PRINCIPAL CITIES. BRANCHES IN NEW YORK
DETROIT • CHICAGO • DALLAS • SAN FRANCISCO • LOS ANGELES**

The complete line of National carbide tools also includes drills, counterbores, milling cutters and end mills.



National

NATIONAL TWIST DRILL & TOOL COMPANY

Rochester, Michigan, U. S. A.

Use Reader Service Card, CIRCLE 7



VOTE AMERICAN...

To vote is to express preference—to register the will of the individual in the course of the nation and world. The true voice of the majority is heard and felt only as each person exercises his God-given right and responsibility to vote. Let's be there when the polls open!

Vote for whom you please. TO VOTE IS AMERICAN!

American **DRILL BUSHING CO.**

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"WORLD'S LARGEST INVENTORY OF PRECISION DRILL JIG BUSHINGS"
TELEPHONE LUDlow 3-6551 TELETYPE LA 1315

new POPE

INTERNAL Precision Grinding SPINDLES

used on BROWN & SHARPE

BRYANT
BULLARD
CINCINNATI
COVEL
EXCELLO

LANDIS
NORTON
REID
THOMPSON
SPRINGFIELD
and others

**with
important
new features
that add up to**

TOLERANCES TO MILLIONTHS

super-precision bearings made to Pope specifications and used exclusively in Pope spindles

total eccentricity of shaft, measured in the tapered hole, will not exceed 20 millionths (.000020)

Assembled spindles are dynamically balanced with all rotating parts in full assembly to 25 millionths (.000025) amplitude of vibration. This assures low micro-inch surface finishes.

INCREASED PRODUCTION

Pope Spindles have the rigidity and the ability to take heavy cuts and produce uniform parts.

LOWER OPERATING AND MAINTENANCE COST

Increased wheel life because the extra large shaft is rigidly supported by ample size bearings.

Saved operating time — one motor driving pulley serves all spindles in most cases.

Permanent lubrication — Pope system of grease lubrication prolongs bearing life, minimizes maintenance expense, and the spindles run cool.

New concealed axial air flow coolant repelling flinger increases bearing life and reduces maintenance expense.

Ask for Catalog No. 57-A and Bulletin No. WA-10, or send us your specifications on the spindles you require.

No. 128

POPE®

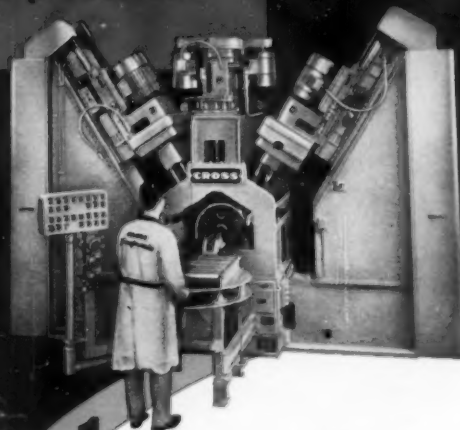
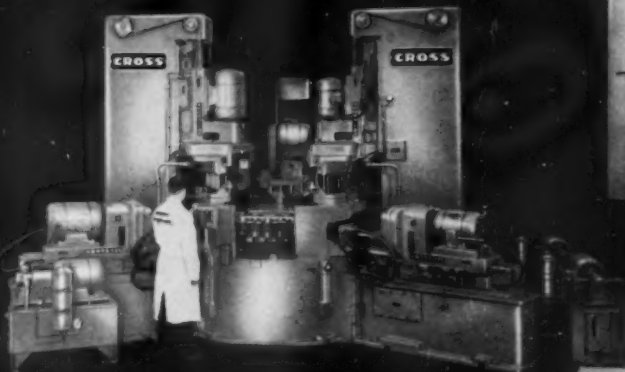
**ENGINEERS, DESIGNS AND BUILDS
PRECISION ANTI-FRICTION BEARING SPINDLES
FOR EVERY PURPOSE**

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

Established 1920

6 ways to automate

Cross automation takes many forms . . .
from the simplest low production machines
to complex equipment for mass production.

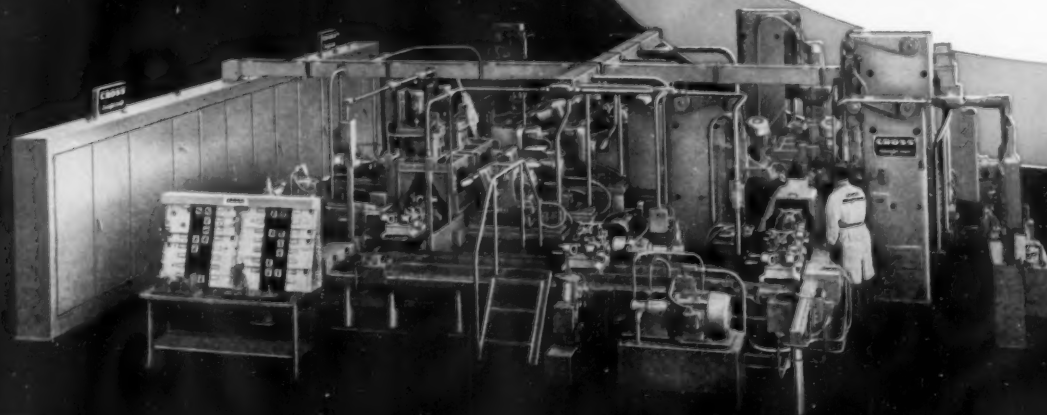


1 CROSS SINGLE STATION MACHINES exist
in many configurations to combine operations.



2 CROSS DIAL TYPE MACHINES provide multiple
station performance with minimum floor space.

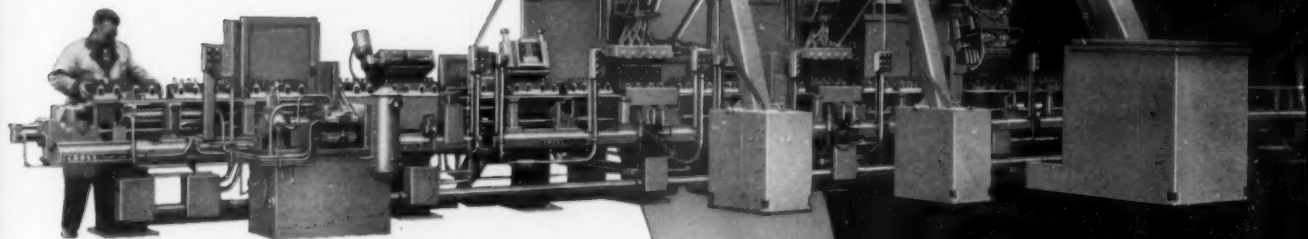
3 CROSS TRUNNION TYPE MACHINES
are compact multiple station units that per-
mit operations on opposite sides of the part.



4 CROSS PALLET TYPE TRANSFER-MATICS
provide capacity for combining a large number of
operations. Standard pallet fixtures handle irregu-
larly shaped parts with maximum flexibility.

CROSS ASSEMBLY TRANSFER-MATICS open
new fields to reduce costs in assembly operations.

6



The six machine types illustrated here were created by Cross to apply the principles of automation to a wide variety of metalworking operations. Thus, Cross makes available the benefits of automation to small or large manufacturers, regardless of required production volume.

Cross sales engineers are available to discuss your automation problems with you. They will also be glad to discuss the new Cross Process Development Service created to solve *unusual* automation problems—in or out of the metalworking field.

CROSS SECTIONIZED TRANSFER-MATICS provide a means of combining unlimited numbers of operations. Automatic in-process work storage minimizes downtime and increases operating efficiency.

5



Established 1898

THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

Basically mechanical . . . reduces complex electronics. Positive control by direct actuation (no feedback). All controls fully integrated with the machine. So practical it needs no provision for manual operation.

Barber-Colman's New Tape-Controlled Lathe

Tape-r

Understands two languages: ... digital data and cost

Now, you can gain all practical advantages of numerical control in a Barber-Colman precision lathe that greatly reduces complexity and equipment cost while retaining the ability to turn tapers and form simple radii.

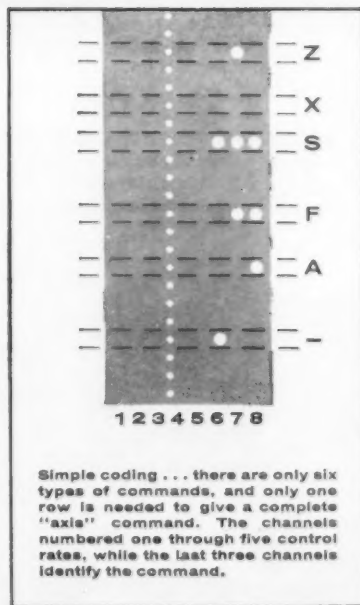
Here is a fresh new approach to numerical control — one that removes any fear of systems incompatibility and leapfrogs into tomorrow's practicalities of low-cost operation and maintenance.

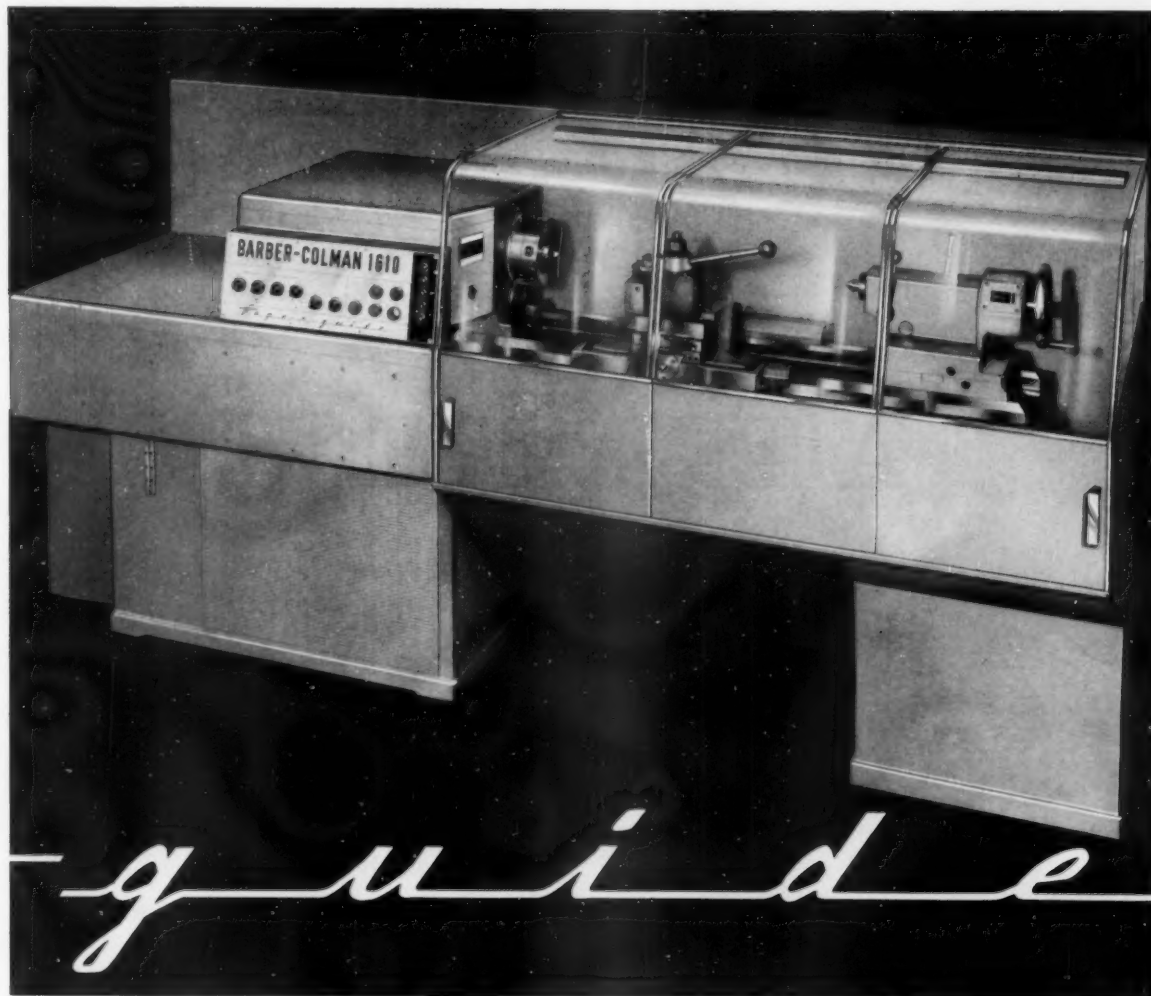
Now, you can sit in the driver's seat — relieve operating personnel of size control responsibility and set production rates on 90% of your routine jobs fitting a 16" swing lathe. The new Tape-r-guide handles all stop-start, positioning, speed adjustment,

and feed change functions automatically from a simple 8-channel binary code tape. It will hold close tolerances on diameter and length, machine all practical tapers without "hunting," cut chamfers without special tools, cutoff and bore or machine at 90° to the work axis—all on a high-performance, precision lathe that has the simplified version of numerical control built-in.

The reader is part of the headstock. Controls are housed in the electrical panel on the back.

The big difference in Tape-r-guide is emphasis on simple and direct mechanical actuation. For example, compound differentials accurately control tapers. Relative speeds of the carriage and cross slide, controlled through mechanical clutches in gear trains, give you true angular tool





paths. There's no sensing and correcting of errors as with a servo drive—no complex electronics or data storage. An electrical signal from the tape reader initiates the mechanical cycle. Cycle then establishes feed rate, spindle speed, and direction . . . as well as any auxiliary functions.

The tape-coding system is simple. Only one row is needed on the tape for a complete axis command. Thus, only a few rows are required for each complete command sequence.

As an incremental system, coding is started from the first operation of the tool rather than from an absolute zero point. The over-all accuracy of the machine is limited only by the system resolution capability . . . plus or minus .001" on diameter and length. The lathe itself is the largest machine

of its type on the market, produces super finishes and precision tolerances—fast. It has large swing capacities (16" and 20"), infinitely variable spindle speeds to 1200 rpm, rapid traverse of the cross slide and carriage, rugged frame castings made of dense Meehanite metal. All setup and operating controls are centralized on the headstock panel, adjacent to the tape reader.

Four dials for preselecting spindle speeds are actuated by tape commands at the proper time in the cycle. Another selector puts the machine into single-cycle operation for setup or fully automatic cycling.

Ask your Barber-Colman representative about the low cost of this basically mechanical, fully integrated, high-speed, numerically controlled lathe.



See the tape-controlled lathe turning tapers, too, in Booth 923 at the Exhibition. Qualified engineers will be on hand to answer questions.

Barber-Colman Company



93 Loomis Street, Rockford, Illinois



A TRIBUTE to the..

Sept. 6-16
1960
CHICAGO,
ILL.

•
The Machine Tool Exposition
International Amphitheatre
•

Production Engineering Show
Navy Pier

— CYLINDRICAL and THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS —

• All of us owe a debt of gratitude to those who have worked so hard to perfect new machinery and to create time-saving features for showing at the Chicago Expositions!

Machine Tool Builders of America!

Little do we realize the coordinated ingenuity and many extra hours required to meet this deadline . . . yet, the machine tool builders of America will not let us down — they again, will help to protect our peace-time economy and defense with facilities for bigger, better and more effective production!

A word to the wise . . . the efficiency of your machine tool investment is protected when you use the best cutting tools and attachments available!

You buy the best when you buy
BATH TAPS and GAGES

John **BATH** & Co., Inc.

28 Mann Street, Worcester, Massachusetts



PRECISION BROACHING

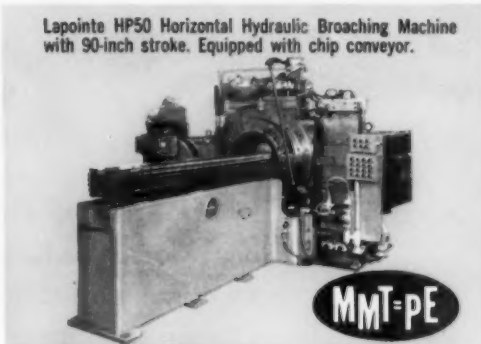
of this large internal ring gear
at a fast, high-production rate

is easy on this 25-ton

LAPOINTE

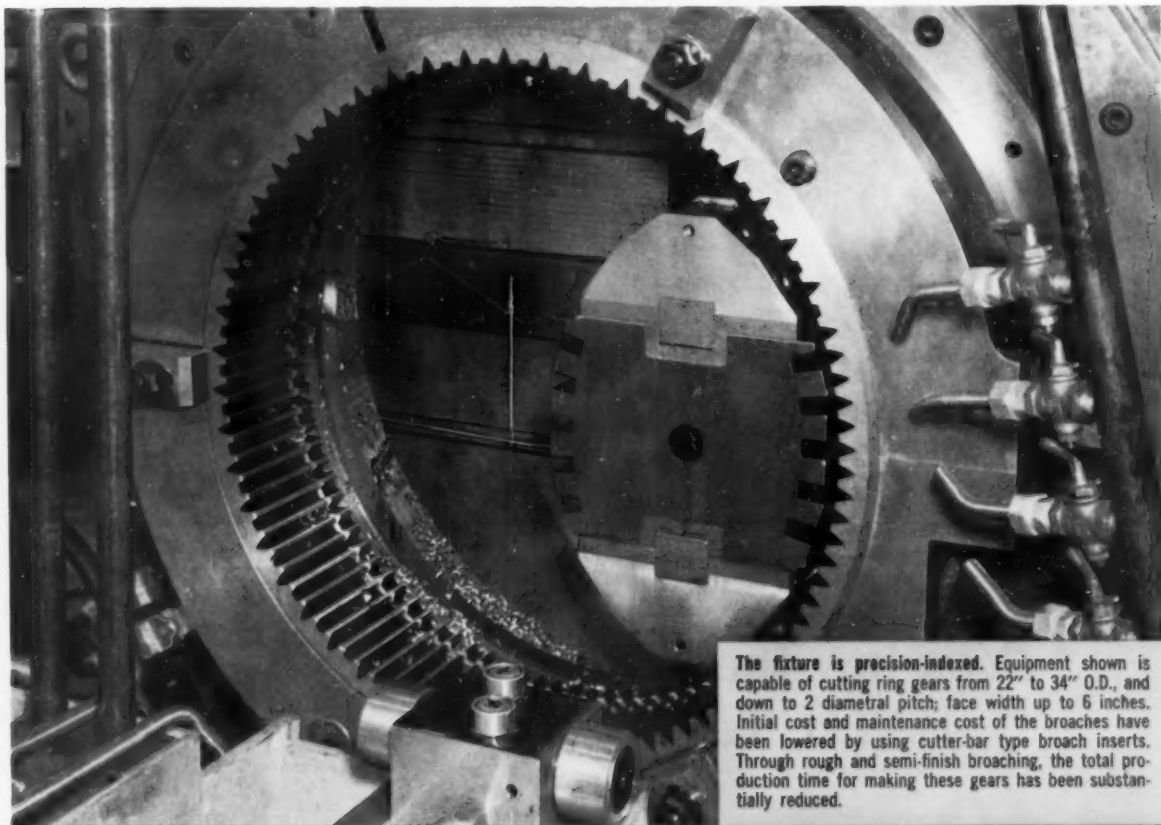
BROACHING MACHINE

Lapointe HP50 Horizontal Hydraulic Broaching Machine
with 90-inch stroke. Equipped with chip conveyor.



Comparing all methods of metal removal, the greatest potential for cost reduction exists in the field of *broaching*.

That's a challenging statement, but here's one proof that it's true: this big ring gear with more than 100 teeth is Lapointe-broached in 32 minutes, floor-to-floor time! The operator merely loads and unloads the parts . . . the broaching cycle is completely automatic, the indexing fixtures operate automatically, and the machine stops automatically after broaching all teeth.



The fixture is precision-indexed. Equipment shown is capable of cutting ring gears from 22" to 34" O.D., and down to 2 diametral pitch; face width up to 6 inches. Initial cost and maintenance cost of the broaches have been lowered by using cutter-bar type broach inserts. Through rough and semi-finish broaching, the total production time for making these gears has been substantially reduced.

THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



LAPOINTE

known to be the best in
BROACHING

SEE GISHOLT

PRODUCTION POINTERS

IN ACTION AT THE SHOW! Booth No. 1042



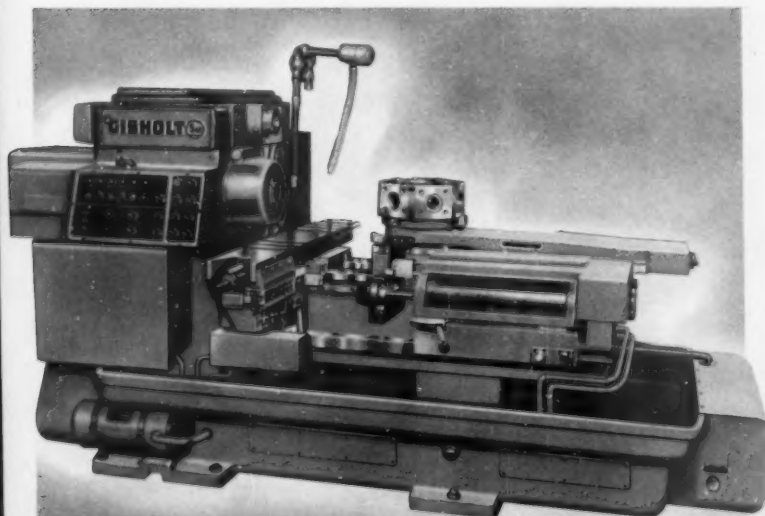
Latest advances in:

Automatic Machining, Tape Control, Balancing, Superfinishing, Tracing

You'll take a big step ahead the moment you set foot in the Gisholt booth — at the Machine Tool Exposition.

The Gisholt booth will be alive with demonstrations showing new ways to cut costs, simplify your work and boost quality.

You'll see dramatic developments in such fields as magnetic and punched tape control—improved techniques in balancing, Superfinishing and automatic machining for job lots and production work. You'll see 15 machines in action—a few of which are shown here.



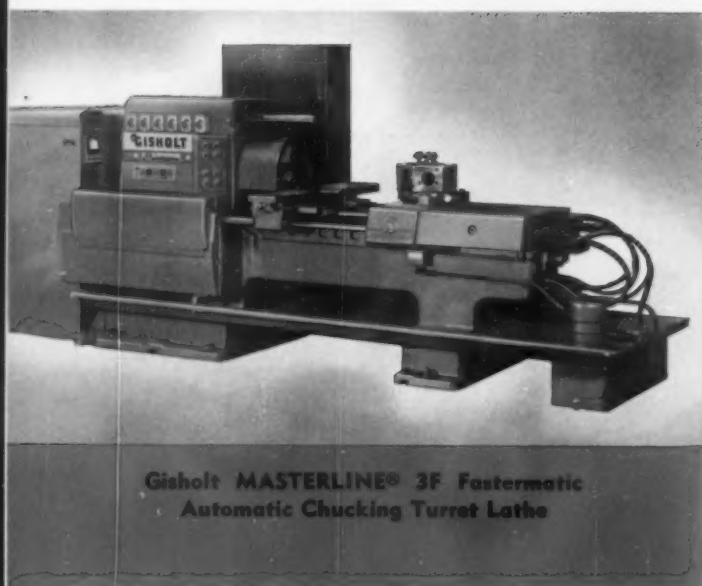
Gisholt MASTERLINE No. 5 AR
Automatic Ram Turret Lathe

First public showing of the Gisholt **AR**®

See the first Automatic Ram Turret Lathe — the Gisholt AR — handle both bar and chucking work with fast setup and automatic cycle machining — new savings in tooling, time — and increased operator productivity.

For information on AR Lathe, circle or write in No. 722 on inquiry card.

**Latest advances
from GISHOLT in action
at the show —
Booth No. 1042**



**Gisholt MASTERLINE® 3F Fastermatic
Automatic Chucking Turret Lathe**

**New *FeeDial*® Control
slashes setup time**

◀ Don't miss the Gisholt 3F Fastermatic Automatic Chucking Turret Lathe featuring new FeeDial Control. Now you can dial your feeds, flick your speed and function switches in just 15 minutes! Then set your tools and take your trial cuts.

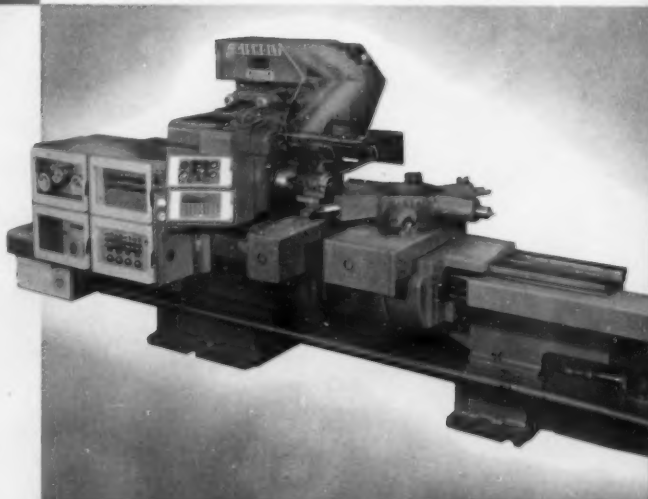
For information on 3F with FeeDial Control, circle or write in No. 723 on inquiry card.

**New FACTROL®
with continuous-path
magnetic tape control**

Push the button on the new Gisholt 101 FACTROL Magnetic Tape Controlled Turret Lathe and watch the standard single-point tools on the hex turret and cross slide machine intricate contour and step work on some really tough parts. See a FACTROL tape prepared on a simplified program computer. ▶

Learn how your engineering department can use the FACTROL 101 to control production, cut your inventory and lead-time requirements — how it can handle your toughest parts with dramatic savings, both in time and in tooling.

For information on Factrol 101, circle or write in No. 724 on inquiry card.



Gisholt MASTERLINE Factrol 101 Turret Lathe

Fastermatic® with point-to-point punched tape control

See a punched tape controlled Fastermatic Automatic Chucking Turret Lathe "think" its way through routine jobs. Again, production is controlled by your engineering department. This is IT for fast setup and automatic production on standard work without contours.

For information on Tape controlled Fastermatic, circle or write in No. 723A on inquiry card.



**Gisholt MASTERLINE 1F Fastermatic
Automatic Chucking Turret Lathe**



Gisholt MASTERLINE 1S Balancing Machine

Balancer boosts production efficiency

Be sure to see the Gisholt 1S Balancing Machine — a machine equipped with "holding" meters. One set of meters for each correction plane indicates exact angle and amount of unbalance, and then "holds" the readings until the part is corrected — reducing chance of operator error and boosting production efficiency.

And watch exacting tests performed on the large Gisholt 4U Balancer. Note that both the 1S and the 4U Balancers require no special mountings — are unaffected by vibration from surrounding equipment.

For information on Balancing Machines, circle or write in No. 725 on inquiry card.

New Superfinisher® with automatic size control

Get the facts on the new Gisholt MASTERLINE 51B Superfinisher — a machine offering new economy on single- or multiple-diameter work. Note how the optional automatic size control offers consistent quality on close-tolerance work.

See the single-spindle, high-production Model 81 Superfinisher for flat, conical or spherical surfaces. Vertical design is ideal for use with in-out conveyor systems . . . requires minimum floor space and may be easily added to high-production lines.

Don't miss the Superfinishing attachments designed to fit on the front carriage of engine or turret lathes. These can also be applied to boring mills, grinders and automatic lathes.

For information on Superfinishing Machines, circle or write in No. 726 on inquiry card.

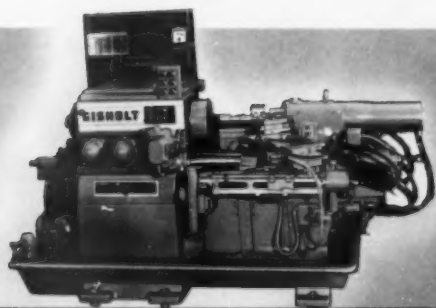


Gisholt MASTERLINE 51B Superfinishing Machine

See Gisholt Production Pointers in action at the show, Booth No. 1042

Rugged 5L makes big jobs simple

See how efficiently the Gisholt MASTERLINE 5L Saddle Type Turret Lathe whips the heavy stock removal problems on massive steel chuck body forgings. Note the rigidity that permits use of ceramic tools on finish facing and turning cuts.

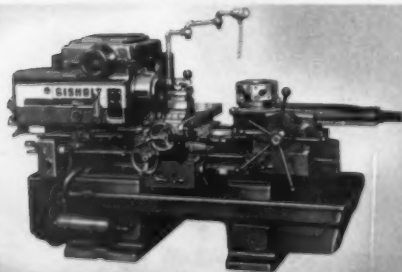


Gisholt MASTERLINE No. 12 Automatic Production Lathe

Simplimatic® cuts costs, boosts accuracy on bevel gear work

Discover the advantages of the Simplimatic's big, flat platen table on bevel gear work — how it permits rigid, compact tooling right up to the work for accuracy, maximum metal removal and long tool life.

For information on Simplimatic, circle or write in No. 728A on inquiry card.



Gisholt MASTERLINE No. 4 Ram Type Turret Lathe

GISHOLT

MACHINE COMPANY
Madison 10, Wisconsin, U.S.A.

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

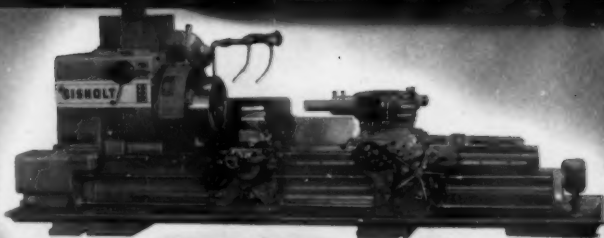
Turret Lathes • Automatic Lathes • Balancers • Superfinishers

Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products



No. 7-860
764

Printed in U.S.A.



Gisholt MASTERLINE 5L Saddle Type Turret Lathe

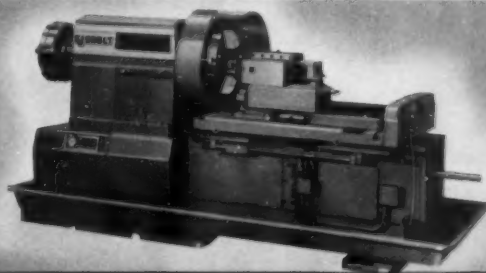
And find out how a Gisholt MASTERLINE 2L Saddle Type Turret Lathe with a turret-mounted JETracer slide tool gives you many of the advantages of automatic operation on a hand-operated machine — eliminates human error, saves on setup time and tooling costs.

For information on 5L Saddle Type Lathes, circle or write in No. 727 on inquiry card.

JETracer® on single-spindle automatic simplifies multiple-diameter work

Watch while a No. 12 Automatic Production Lathe, equipped with a 4-pass JETracer on the front carriage, makes short work of multiple-diameter machining — contours, steps and radii. A ceramic tool on the final pass holds close tolerances and provides fine finish.

For information on No. 12 Automatic, circle or write in No. 728 on inquiry card.



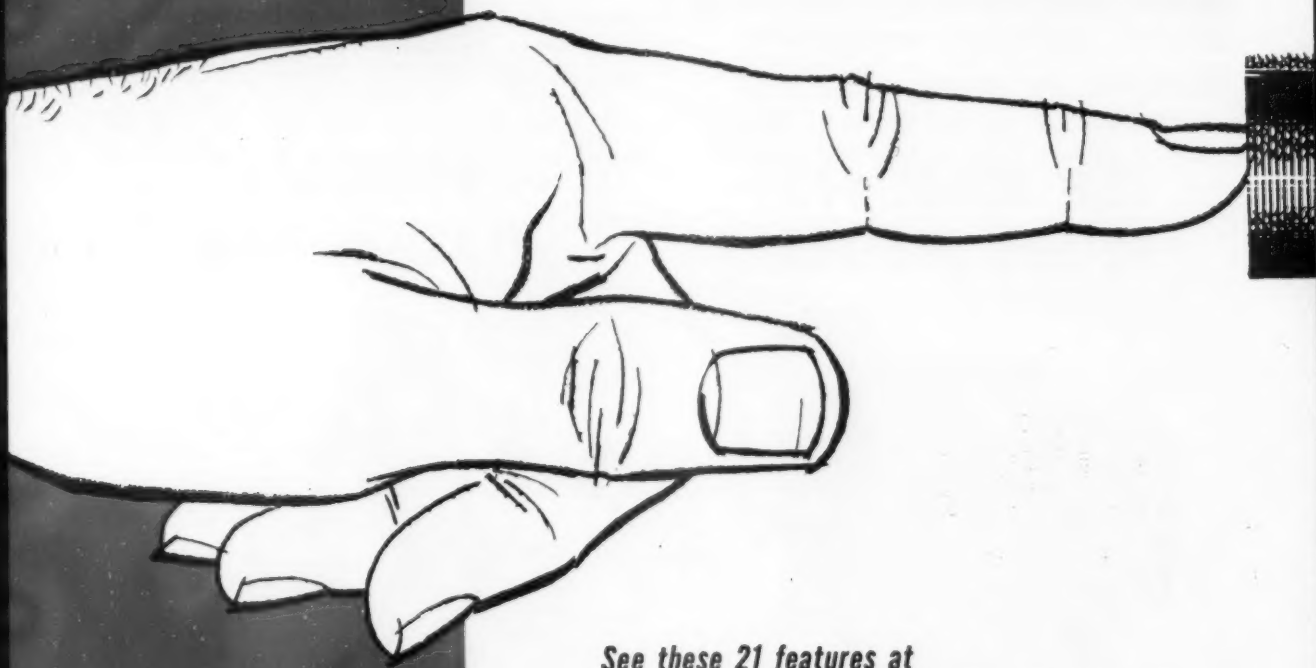
Gisholt MASTERLINE Simplimatic Automatic Lathe

JETracer on bridge-type cross slide adds flexibility

And see how the Gisholt JETracer brings new cost and time savings to contour work on a standard Gisholt MASTERLINE No. 4 Ram Type Turret Lathe.

For information on Ram Type Turret Lathes, circle or write in No. 722A on inquiry card.

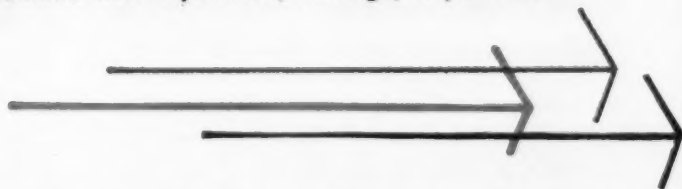
ANNOUNCING
21
NEW EX-CELL-O
PRODUCTION
EFFICIENCY
BREAKTHROUGHS



See these 21 features at

EX-CELL-O's BOOTH 946

Machine Tool Exposition, Chicago, Sept. 6-16.



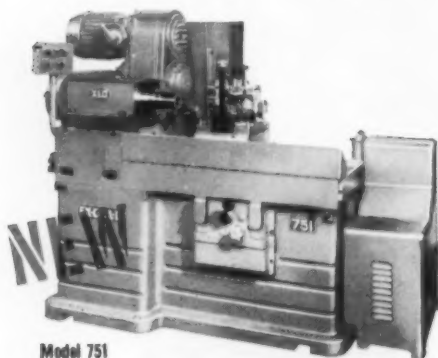
NOTE: Immediately following these 4 Ex-Cell-O pages you'll find ads for Bryant Chucking Grinder Co., Michigan Tool Co. and Optical Gaging Products, Inc.—subsidiaries of Ex-Cell-O.

Use Reader Service Card, CIRCLE 20

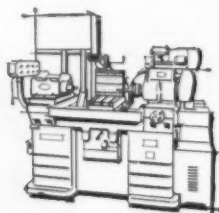


ANNOUNCING 21 NEW EX-CELL-O

NEW LINE OF PRECISION BORING MACHINES

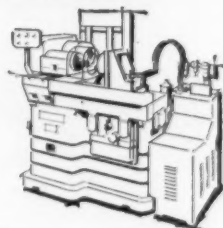


Model 751

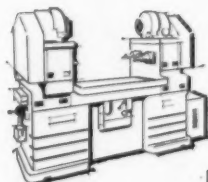


Model 732

NEW



Model 731

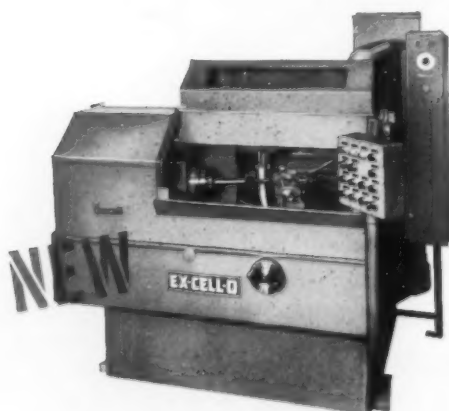


Model 752

- 1 Temperature controlled hydraulic panels
- 2 Greater rigidity and stability in bases and tables
- 3 Hydraulic and coolant systems externally mounted
- 4 New standard heavy duty spindles

Maximum dimensional stability under all kinds of operating conditions, and accurate repeatability on boring, turning, facing, counterboring, chamfering, recessing and trepanning operations are the forte of this new line of Ex-Cell-O Standard Precision Boring Machines.

NEW MODEL 973 GROOVE GRINDER

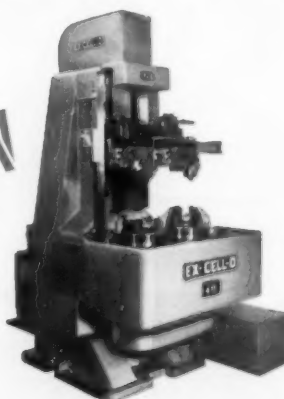


- 5 Positive cam control of variable wheel feed and sparkout
- 6 Hydraulically operated cross slide movements

Maximum speed and precision in the grinding of single, or multiple, grooves or forms mark this new machine's potential for breaking production efficiency barriers.

MODEL 411 VERTICAL BORE

NEW



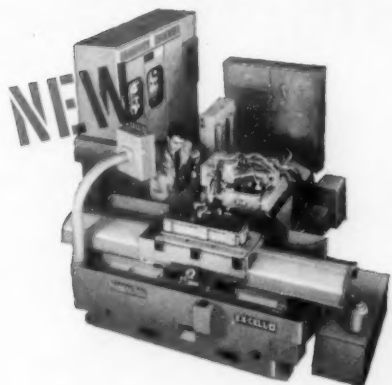
- 7 Single column construction
- 8 Seven different arrangements available

Versatility is the production efficiency feature of the new Model 411 Ex-Cell-O Vertical Precision Boring Machine. Easy tool changing and safe, easy, loading of heavy parts also contribute to this precision machine's effectiveness.

60-658

PRODUCTION EFFICIENCY BREAKTHROUGHS

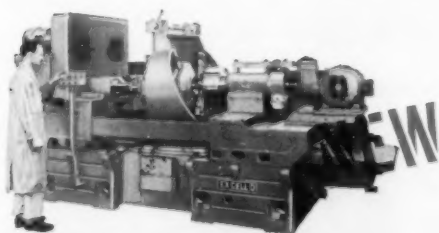
MODEL 922 NUMERA-TROL



- 9** Slides controllable to 25 millionths of an inch
- 10** Lead time, tooling, engineering and production costs minimized

The Model 922, a two dimensional tape controlled, ultra-precision machine tool for turning or boring intricate contours or grinding cams and templets. Designed to operate from any high performance numerical control system, it's a most effective means for reducing metalworking overhead.

LARGEST PRECISION BORING MACHINE



- 11** Massive, heavy construction
- 12** Hydraulics—Infinite feeds, thrust-load compensation

Accuracy, heavy cuts and good finishes on large parts are the high-production characteristics of the Ex-Cell-O Model 772 Horizontal Precision Boring Machine. This largest horizontal boring machine in the Ex-Cell-O line is designed for maximum machine cycle efficiency.

60-65C

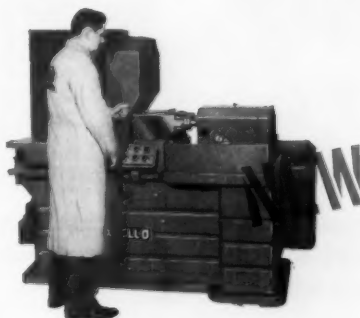
MODEL 244 VERTICAL ELECTROSPARK MACHINE



- 13** Electrodes of various materials are used to form intricate shapes in hard conductive materials

For fast and accurate drilling, piercing, trepanning and cavity sinking in carbides, die steels, etc. The Ex-Cell-O Vertical Electrospark Machine offers all the advantages of electro-discharge machining.

MODEL 308 CAM BORE



- 14** Positive, direct cam control, no levers, on table and cross slide
- 15** Fast, easy, cam changing for maximum versatility

On production parts requiring close-tolerance contouring, boring, turning, facing and grooving—singly or in various combinations—the Ex-Cell-O Models 308 and 312 Cam Boring Machines feature reliable repeatability for high production and quality.

MORE EX-CELL-O/ANNOUNCEMENTS



ANNOUNCING 21 NEW EX-CELL-O PRODUCTION EFFICIENCY BREAKTHROUGHS

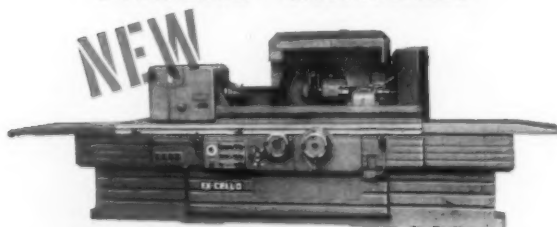
MODEL 264 ELECTROLYTIC TOOL GRINDER



- 16** Cuts diamond wheel costs
- 17** Grinds both tool faces and chip breakers

Face grinding on one end and chip breaker grinding on the other —this Reciprocating Tool Grinder grinds high speed steel and carbide tools to blue print specifications quickly, at low diamond wheel cost, and without risk of heat checking.

MODEL 36 THREAD GRINDER



- 18** Automatic wheel dressing, size compensation, wheel feed, retract, extra long leads, backlash compensation, and work speed control
- 19** For production or tool room use

The hydraulically operated and electrically controlled Model 36 Thread Grinder produces accurately ground threads, internal or external, with minimum waste of time, labor or material. Single or multiple rib wheels may be used.

MULTIPLE SPINDLE PRECISION BORING



- 20** Interchangeable multiple-spindle plates
- 21** Fully automatic cycle for multiple hole precision boring

Full utilization on many jobs is afforded through the easily-changed multiple-spindle plates featured on Ex-Cell-O's Models 711 and 712 Precision Boring Machines. Built-in cross slide permits indexing between bores or sets of bores.

ALSO IN BOOTH 946

- Building Block Set-ups ■ Center Lapping Machine ■ Grinding Wheel Dressers ■ Grinding and Boring Spindles ■ Quill-type Hydraulic Power Units ■ Drill Jig Bushings ■ Micron Sections ■ Precision Production Parts ■ Continental Broaches, Cutting Tools, Counterbores ■ Rotac Torque Actuators ■ Magna-Sine Magnetic and Non-Magnetic Sine Plates ■ Bryant Gages and Surface Plates ■ Cadillac Gages ■ Contour Projectors and Accessories

EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • RAILROAD PINS AND BUSHINGS • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O
CORPORATION
DETROIT 22, MICHIGAN

Cut Out Surplus Setup Time

You can do exactly that with Michigan-Lorenz line of universal hobbers and shapers (Models up to 200 in.). No change gears to bother with in selecting speeds and feeds on the hobbers. Just dial them in. You can't help but get better tool life. And their ultra-rigidity spells ACCURACY.

★Who Said You Can't Make Gears Any Better?

There is a simple way to make even the best gears better—give them a final touch-up (after heat-treat) on a Michigan abrasive gear finisher. Improves the surface finish, takes out the burrs and tiny nicks from handling, pulls noise level way down. (Yes, it even corrects small lead errors.) Part of the secret is in Michigan's exclusive Roto-Lube coolant, incidentally. Ask for Bulletin 999-60.

★Tiny Grinding Wheels Do Big Job

It's fascinating to watch those tiny grinding wheels race around both ends of gear teeth on the Michigan 482 (for bevel gears) and 482A (for spur and helicals). In just seconds they deburr and chamfer the entire profile—top root and flanks—of every tooth on a gear. Ask for bulletins by machine number.

★Dial Type Loaders Cut Cycle Time

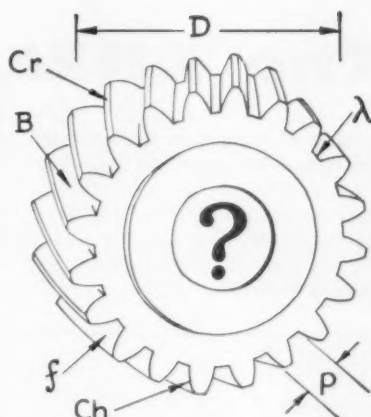
Dial type loaders which cut cycle time while protecting the machine against mis-cycling are now available on a variety of Michigan Tool machines including the Mark II gear finisher and the 999 abrasive gear finisher.

★It's Amazing What You Can Save With the Low-Cost #607

There's a bench type checking fixture that will handle gears up to six inches in diameter, will eliminate use of ball mikes, tells you if there is runout and how much, checks size to tenths and smoothness of rolling action. Ask for Bulletin 607.

★Forms Precision Spline and Thread in Seconds

Did you know you could perform multiple operations—like spline and thread rolling—in a single stroke of a Roto-Flo machine? It's being done successfully



in regular production. What's more these machines are so versatile that they are being used for semi-job lot runs. Ask for Bulletin RF-60.

Plunge Feed Makes 1458-B Fastest Hobber

If you want to know what real hobbing speed can be, look into the Michigan 1458-B Ultra-Speed. Its infinitely variable feed rate is only part of the story. Designed for continuous production. Not recommended for job shops (a Michigan-Lorenz is best for that). Ask for Bulletin 1458-B-60.

★Play Safe With Package Tooling

Now from TWO Michigan Tool plants you can get package gear tooling engineered as a unit to give you perfect gears. Avoids such things as sharp fillets, poor cleanup, incorrect contacts, shaving cutters and master gears not being properly matched. "Package" covers hobs, shaper cutters, shaving cutters, abrasive finishers, master gears, etc.

★Now You Can Grind Crowned Gears To Tenths

A fully automatic gear grinder that maintains true involute form and produces either uncrowned or crowned gears (to radii of 0 to 12 inches). Automatic wheel dressing. Nothing for operator to do but load and unload. Highly versatile. Wide choice of setup possibilities. Roughs, semi-finishes and fin-

12 NEW GEAR IDEAS SPELL BONANZA

ishes in same automatic cycle. Ask for Bulletin CCG-60.

★A Gear Finisher You Set Up With Dials

That's what the new Mark II makes possible. And you can shave the gears straight, crowned or tapered or both tapered and crowned with just ONE attachment. More beef than any other shaver for top accuracy. Amazing ease of setup and a honey for automatic loading. Fastest cycle time. Modular construction. Plus a host of other features. Ask for Bulletin 870-60.

Gear Checkers Go Optical

The latest lead and involute checkers now carry optical heads that not only boost accuracy but also speed up the checking process. On lead checkers ask us for Bulletin 1218A-60; on involute checkers it's 1124-60. (Yes, you can do spacing on either one.)

★World's Fastest Gear Cutting Machine Now Has Through Feed

For cutting spur gears, splines, ratchets and other toothed forms there is just nothing anywhere that will touch the Shear-Speed. Now the Model #30 is available in an open double-column design, tied together across the top giving it even greater accuracy. See how easy automatic chip removal can be. Ask for Bulletin SS-60.

★ On display at the National Machine Tool Exposition, Sept. 6-16.



MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. DETROIT 12, MICH.





The BRYANT exhibit

If high-production, low-cost internal grinding is an important factor in your manufacturing operation, don't miss Bryant Booth #936. You'll see grinding done at eye-opening production rates by these advanced-design Bryant machines.

Bryant UNIVERSAL Internal Grinder

A completely new, low-cost, general purpose machine for I.D., O.D., internal face and rotary grinding. Incorporates many plus values not found in other low-cost machines.

Bryant MODEL "B" MINIATURE CENTALIGN®

Miniature Centaligns will demonstrate the grinding of minute bores and raceways in miniature bearing races. The Model "B" is a truly miniaturized machine, offering such noteworthy features as Bryant's production-proven disc drive workhead, quick-change "packaged tooling", and "New Wheel Dress" mechanism.

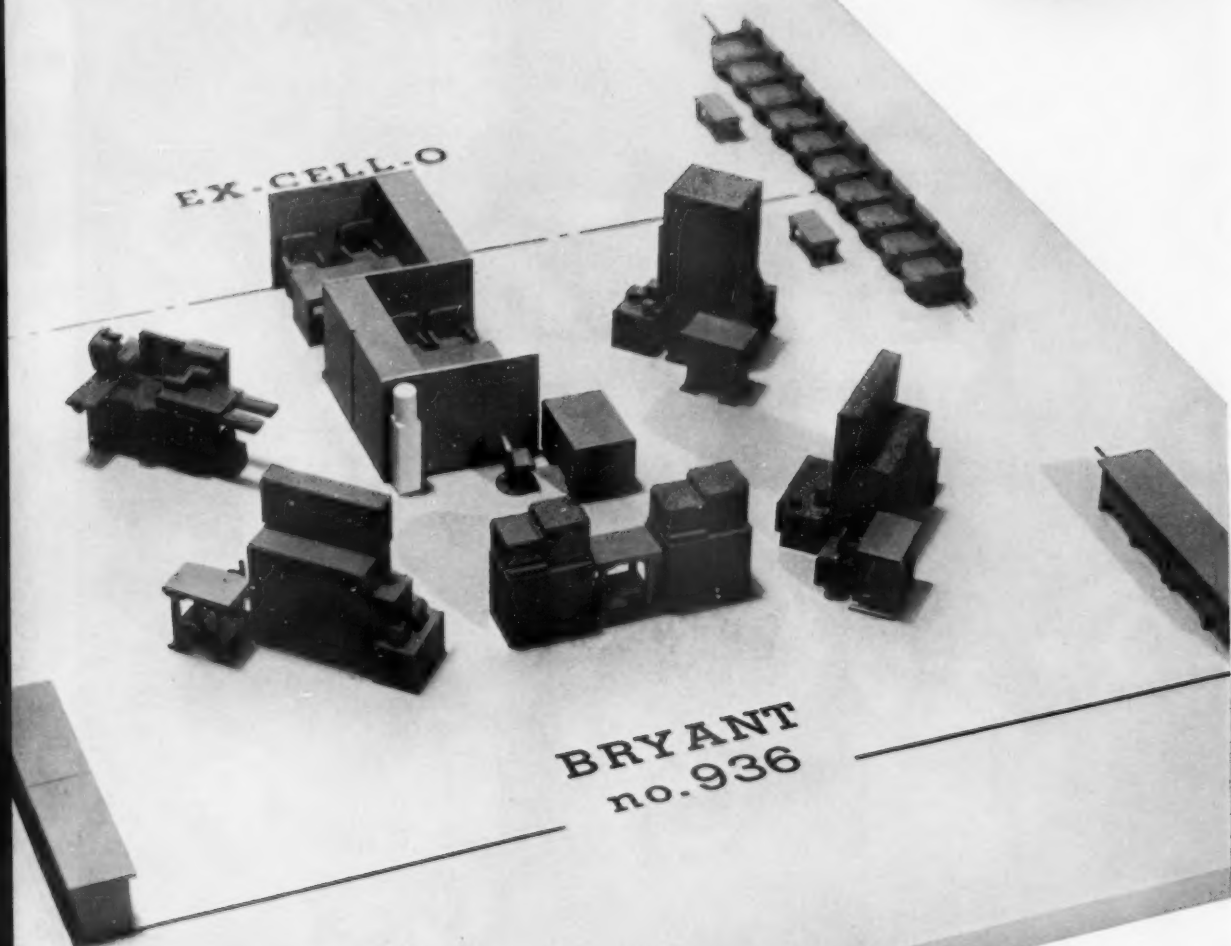
Bryant VERTICAL CAM Grinder

This vertically constructed machine greatly multiplies the production of contoured bores. The operation of the eccentric workholding fixtures in a horizontal plane increases production, loads faster and easier. This grinder is of Centalign unit type construction, requiring a minimum of floor space. The high-production grinding of contoured bores will be demonstrated.

Bryant MODEL "C" CENTALIGN®

The standard for dependability, speed and accuracy in the world's major production lines. Featuring the exclusive Centalign wheelslide construction, cycle control by programming cams, and time-saving, split-second work handling.

is a "MUST-SEE" at Chicago!



BRYANT

BRYANT CHUCKING GRINDER COMPANY

58 Clinton Street, Springfield, Vermont, U.S.A.

Offices: Springfield, N. J. • Cleveland • Detroit • Indianapolis • Chicago

Precision Internal Grinders • Spindles • Special Machinery and Components

MODEL 14-5
The Finest, Most Versatile,
14" Screen Contour Projector Available.

MODEL 8
Economical 8" Screen Projector. Can be used in Horizontal or Vertical Position.

MODEL 14-2A
A Precision Measuring,
Bench Model Projector for
All-Around Use.

EX-CELL-O

CONTOUR PROJECTORS* FIT YOUR OPTICAL GAGING REQUIREMENTS

MODEL 30
A True, Heavy Duty Precision Measuring Projector with 30" Diameter Screen, and 12" Diameter Capacity.

MODEL 14-6
with Plain Table for Production-Line Use with Chart-Gages and Fixtures.

MODEL 14-6
with Measuring Table for Production-Line or Limited Tool Room Use.



Write for new edition of
EX-CELL-O Contour Projector
Booklet—Available Now!



Manufactured by EX-CELL-O Corporation at Detroit, Mich.

SOLD AND SERVICED BY

OPTICAL GAGING PRODUCTS, INC.

26 FORBES STREET

ROCHESTER 11, N. Y.

(A subsidiary of EX-CELL-O Corporation)

★ Since 1957, applied in 20,000 special boring, facing, turning, milling and chamfering tools

★ Simplifies combining of operations

WESSON Standardized Cartridge System Revolutionizes Special Tool Field

This little cartridge is the simple answer to thousands of special tool needs.

In only 3 years, the Wesson adjustable cartridge tooling system has revolutionized the design of thousands of multiple point tools for boring, milling, chamfering, turning and facing. (For examples, turn the page.)

The standard 5 styles shown below, alone, cover the vast majority of all special multi-point tool requirements resulting in minimum inventory cost, minimum tool design and fabricating cost. From 2 to 18 or more operations may be combined in a single tool with the Wesson cartridges. Adjustable in two directions, the cartridges with their throw-away inserts cut down-time for setup and tool changes. They come in 5 styles (for square, triangular or pentagonal inserts) and in left and right hand types.

The same cartridge can be used for machining

different materials simply by switching to the required Wessonmetal grade. When a tool is no longer needed, cartridges can be switched to other uses. Damaged cartridges can be quickly replaced from stock, avoid high special tool replacement cost.

You can often use special tools for different size parts by simply adjusting the cartridges. Designed to provide maximum chip clearance and to protect the cutter body, cartridges are rigidly retained in the body.

Get our latest bulletin (C-660) on these standardized cartridges by circling A-2 on the Readers' Service Card. Circle A-1 and our representative in your area will show you numerous illustrations of some of the 20,000 different special tools in which these cartridges have proven themselves.

Please turn the page . . .



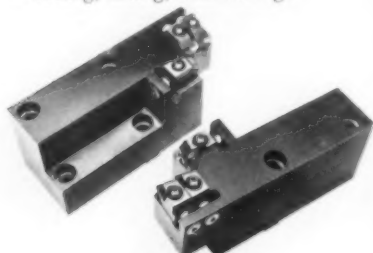
These 5 cartridges will take care of almost all special tools.

Some of the many specials using WESSON cartridges



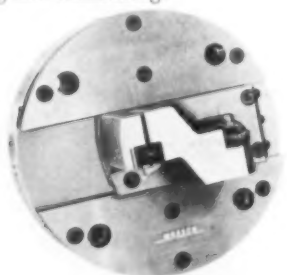
AUTO TRANSMISSION CASE

15 different operations with one tool —boring, facing, chamfering.



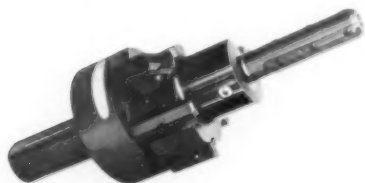
AUTOMOTIVE

Simple tool block for multiple turning and chamfering.



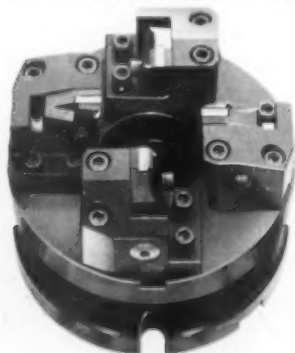
HYDRAULIC VALVES

Interchangeable preset blocks and cartridges face ends of all valve sizes.



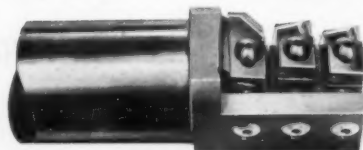
ELECTRIC MOTORS

Bores and faces all bearings, chamfers OD, ID on various sizes of motors.



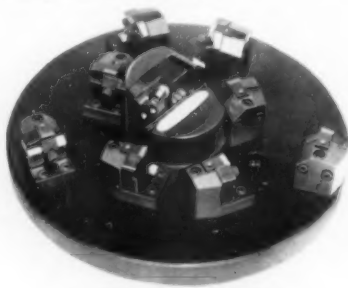
STEERING ASSEMBLIES

Hollow mill turns ends of control arm shafts.



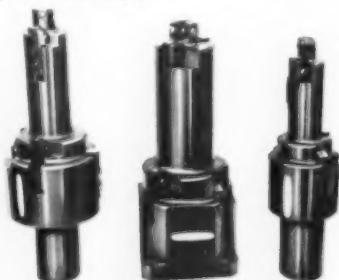
AIRCRAFT ENGINES

Simple boring bars perform multiple boring and chamfering.



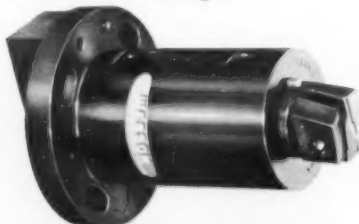
CLUTCH HOUSING

Bores and faces clutch housing of cast aluminum. Facing units have special cartridges.



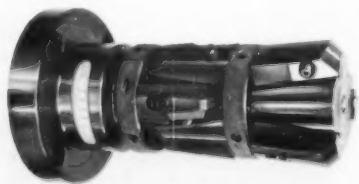
BRAKE DRUMS

This boring tool R & F bores brake drums with 8 cartridges.



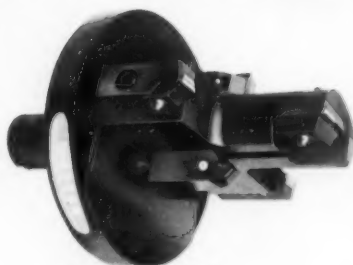
ALUMINUM SLABS

Milling cutter units to closely control face run-out in slab milling of aluminum ingots.



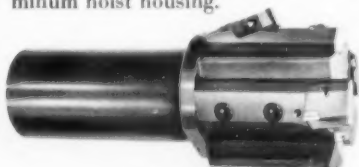
CONNECTING RODS

Rough and finish bores big ends of rods. Three cartridges per diameter simultaneously adjustable.



HOISTS

Semi-finish bores, chamfers end and faces flange in one operation on aluminum hoist housing.



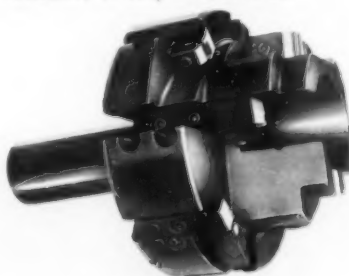
TRACTORS

Rough bores, grooves, chamfers both ends and finish bores collar coupling.



ROAD BUILDING EQUIPMENT

R & F connecting rods to a diameter tolerance of only ± 0.0002 in.



CONVERTER

Bores, counterbores, turns ID of hub, triple-faces and double-chamfers converter housing.

WESSON COMPANY, DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 Judge Road, Toronto 18, Ontario

Still using the gay nineties approach to Tool Steel?



Use the New, Modern A-L Steelector System

Now you can accurately select the proper tool steel based on its individual characteristics and be sure that it's available for off-the-shelf delivery before you place your order.

The new Allegheny Ludlum STEELECTOR Program makes tool steel selection fast. And it eliminates the embarrassment of specifying a grade which later turns out to be unavailable or available only after a costly delay.

The leading grades of tool steel that meet 96 percent of all applications—as listed in the Allegheny Ludlum Tool Steel Handbook—form the basis of the STEELECTOR Program. The STEELECTOR Grades are charted on cards covering each group of steels (tool room, hot work, and high speed grades) to help you select the particular grade best for your application.

Bar graphs on each STEELECTOR Card show how the various grades compare in abrasion resistance, toughness,

size stability, machinability and red hardness. It's easy to determine accurately the combination of properties that best suits the job at hand.

The complete necessary range of sizes and shapes is listed in a special Data Stock List for every grade. These lists also include heat treating, typical working hardnesses and other data to insure that your selection is correct.

You can choose with confidence because every STEELECTOR grade has been selected from the complete line of Allegheny Ludlum Tool Steel and made under the rigid quality control standards of all A-L products.

For a complete explanation of the STEELECTOR Program, ask your Allegheny Ludlum sales representative for a copy of the colorful A-L Tool Steel STEELECTOR Booklet, or write: *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania. Address Dept. TE-9.*

STEELECTOR
PROGRAM



ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country

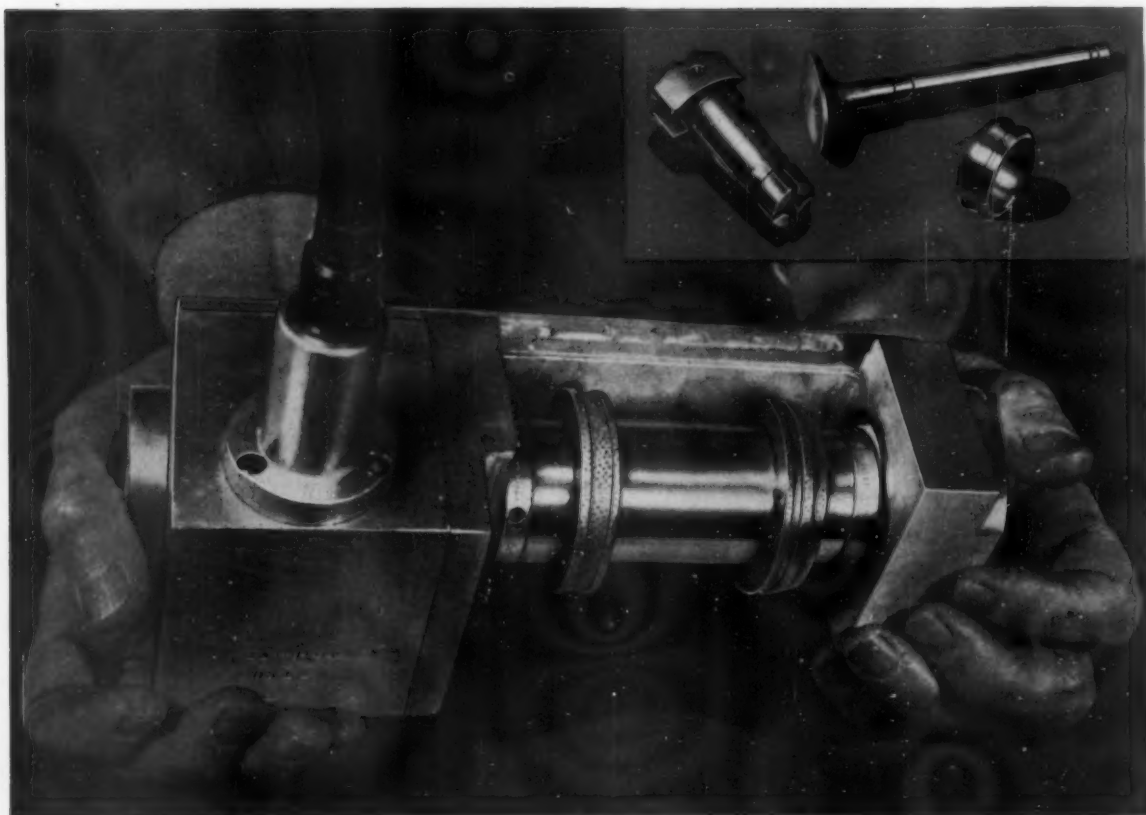


2083

Use Reader Service Card, CIRCLE A-1

Use Reader Service Card, CIRCLE 28

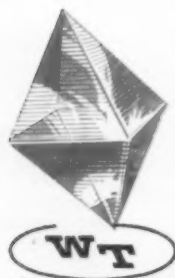
31



THIS TRU-GRIT® ROTARY DIAMOND DRESSING WHEEL forms grinding wheels with speed, accuracy and economy unapproached by any other method

It form dresses ANY grinding wheel—vitrified, resinoid, silicate, rubber or shellac bond. It has none of the limitations of crusher roll or single point diamond tool forming; it develops complex configurations and sharp, deep, square grooves with absolute accuracy, assuring exact reproduction in the work piece. It may do this in a single, quick pass between ejection and loading, without interrupting the production cycle. Downtime for tool changing on every shift is out; the Tru-Grit Rotary Diamond Dressing Wheel's finishing and dressing life goes far beyond anything known before. Savings

in downtime, the increased number of pieces produced, the lower cost per piece over the life of the Tru-Grit Rotary Wheel are things to make cost engineers take a second look. But, perhaps the most dramatic difference of all is in the meticulous accuracy, fine finish and routine uniformity of the processed pieces. This is what quality control engineers have dreamed about and it makes quality control reports something of a formality. If you'd like facts and figures on actual applications of the Tru-Grit Rotary Diamond Dressing Wheel, write us.



WHEEL TRUEING TOOL COMPANY

1910 SEMI-CENTENNIAL 1960

Main plant and office: 143-3200 W. DAVISON, DETROIT 38, MICHIGAN

Southwestern plant: DALLAS, TEXAS • Western plant: LOS ANGELES, CALIFORNIA

Eastern affiliate: WHEEL TRUEING TOOL COMPANY OF NEW JERSEY, BLOOMFIELD, N.J.

Canadian plant: WHEEL TRUEING TOOL COMPANY OF CANADA, LTD., WINDSOR, ONT.

Oldest and largest diamond and diamond tool specialists in the Western Hemisphere

INDUSTRIAL DIAMONDS • DIAMOND TOOLS • DIAMOND-MISER TOOL TURNING DEVICES • MINING AND OIL
FIELD DIAMOND DRILLS • MASONRY DIAMOND DRILLS AND SAWS • PORTABLE DRILLING MACHINES AND SAWS

What?

America's finest automatic transfer machines made by a light bulb manufacturer!

Many years ago we discovered that Sylvania specifications for automation equipment were so exacting, we had to make the machines ourselves. Nothing accurate enough was available anywhere, at any price.

For 20 years we have been making this automation machinery to produce our own light bulbs, radio tubes, fine electronics equipment. No one has ever equaled Sylvania automation machinery for accuracy and long-term dependability.

Now these machines are available to outside companies seeking this same extraordinary degree of accuracy.

Ideal for high-speed automatic fabricating, finishing, assembling, indexing, packaging, these machines are available in two general types:



1. Conveyor indexing chassis, exceptional for the extreme accuracy, strength, and versatility of its chain—not made commercially, but by

Sylvania itself. Chassis also provides greater tool and driving capacity than other such chassis on the market.



2. Rotary indexing chassis in two sizes and in single and double turret models. Made with unusually great driving and tool capacity. Top of the transmission spider is specially machined for rotary vacuum or pressure valve.

Also, precision indexing transmissions (5 models)

- **Heavy-duty unit** with extra-large cam well and spider diameter for wider range of stops per revolution.
- **Standard unit** features higher cam speeds, a provision to integrally mount rotary vacuum or pressure valves.
- **Universal unit** operates with its output shaft horizontal or vertical. Has wide range of applications.
- **Small universal unit.** Lower silhouette and extra-long input shaft are main features of this extremely durable, accurate transmission.
- **Conveyor unit.** Very rugged, heavy-duty unit designed for conveyors, but easily adaptable for rotary tables, other intermittent motion machines.

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Equipment Development Plant
121 Loring Avenue, Salem, Mass.

Please send me free brochure of:

☐ ROTARY ☐ CONVEYOR ☐ TRANSMISSIONS

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Company _____

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City _____

Zone _____

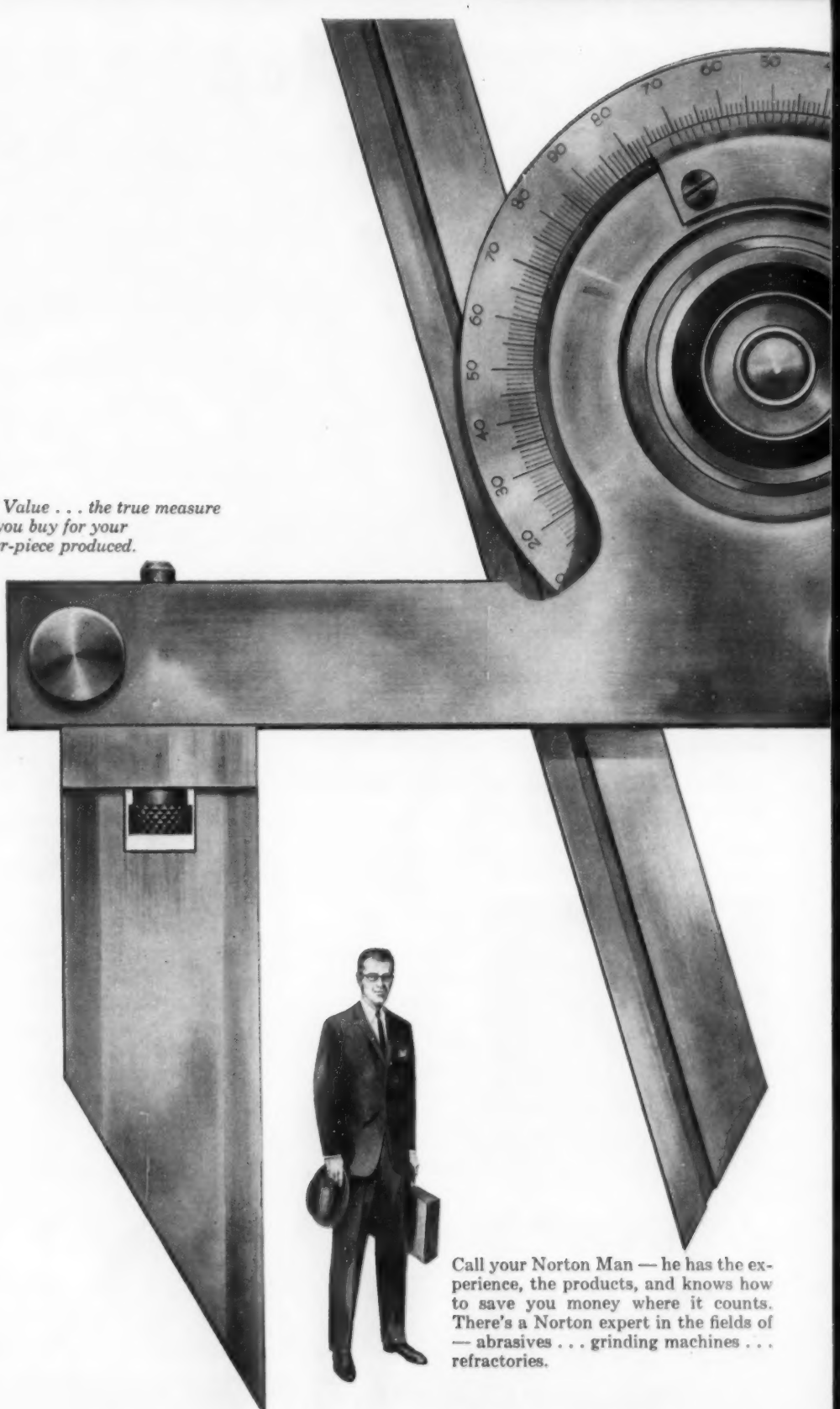
State _____



SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**





The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.

Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives . . . grinding machines . . . refractories.



You can produce greater savings than you can buy

It is not how much you spend, but what you receive for your money that determines a bargain.

The economic truth of the above statement applies to all manufacturing and is especially true in grinding wheels.

There are cheaper grinding wheels than Norton wheels — and on the invoice they may look like a bargain. But if the wheels purchased fail to perform efficiently on the production line or incur production delays because of poor quality or misapplication — a higher cost of production is the price actually paid.

In brief, *the true measure of grinding wheel value is not how much you paid for it — but how much you get from it. Here is what you can get from Norton —*

Norton Company gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field — and you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Your Norton Man starts his career by spending a minimum of one year in a carefully planned training course in the Norton plant and a comparable period of training in the field. The Norton Man has an average of 15 years' abrasive experience in addi-

tion to the specialized training. He is the most knowledgeable man in abrasives that you can consult. He is your consulting abrasive engineer.

He will make a free Abrasive Requirement Study for you. This study lists the correct specifications for each abrasive job in your plant to assure you lowest cost-per-piece produced. He is also available for complete field testing on specific problems.

For example, your Norton Man can increase production by pointing out ways to better wheel usage and fewer wheel changes. He has the widest selection of grinding wheels in the industry to help him select the perfect wheel for new product grinding operations and improving your current grinding jobs — both at the lowest cost.

Norton economy pays off in lower cost-per-piece produced. Call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

W-1973

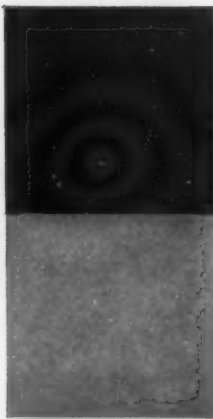
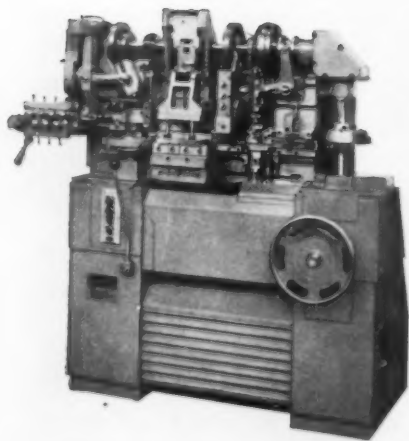


75 years of... **Making better products...to make your products better**

THESE PARTS ARE BEING PRODUCED AT SPEEDS OF 90 TO 250 PCS/MIN



PROFIT-TREE!



These are formed parts produced in single automatic operations on the revolutionary new Torrington Vertical 4-Slide.

With precision and speed, the Verti-Slide has replaced as many as five and six progressively tooled presses in the production of a complex part. Normal secondary operations such as welding are being done in one continuous automatic operation in excess of 100 pcs/min.

If you make or buy complex wire or strip parts, the Verti-Slide method offers dramatic reductions in production cost. Less parts handling, in process inventory, machine space—all mean greater profits to you.

Write or call for field technical data or a Torrington Sales Engineer.

THE TORRINGTON MANUFACTURING COMPANY

MACHINE DIVISION Torrington, Connecticut

Use Reader Service Card, CIRCLE 33

part of a COMPLETE efficiency-proved line . . .

SIMONDS MOUNTED WHEELS

here's why they're your best buy for


BETTER GRINDING




Consistently superior performance because they're made in the right grain and grade combinations for the jobs they have to do. *Mechanical accuracy* you can count on for true concentricity, precise wheel shape and top cutting efficiency. *Stainless steel mandrels securely bonded to wheel . . . specially fluted . . . guaranteed not to come loose or pull off.*

The COMPLETE line for complete satisfaction. Grinding wheels are our business . . . and our business is to help your business with top quality grinding wheels including Diamond Wheels, man-made and natural . . . precision grinding wheels; centerless, cylindrical, etc. . . abrasive segments . . . snagging wheels . . . Double XX weld grinding wheels, etc. Just name what you need and your Simonds distributor will supply it.

Write for Mounted Wheel Catalog ESA-67



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Division of Simonds Saw and Steel Co.
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valves

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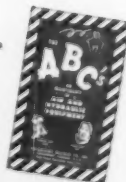
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of air and hydraulic equipment

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A down-to-earth
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16

exceptional quality
British-made

PRECISION MACHINE TOOLS

presented by

LAPOINTE

at the

2nd

COLISEUM Machinery SHOW

Chicago Coliseum, Sept. 7-15, 1960
(near the Loop)

A working exhibit...

every machine under power!

INDEX

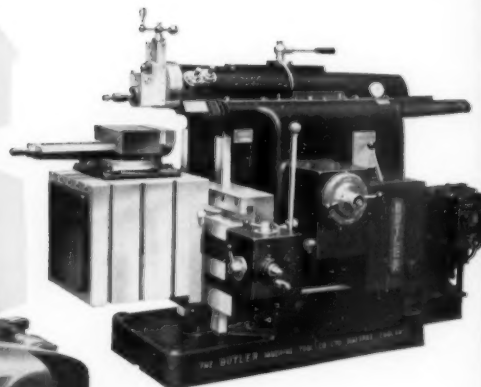
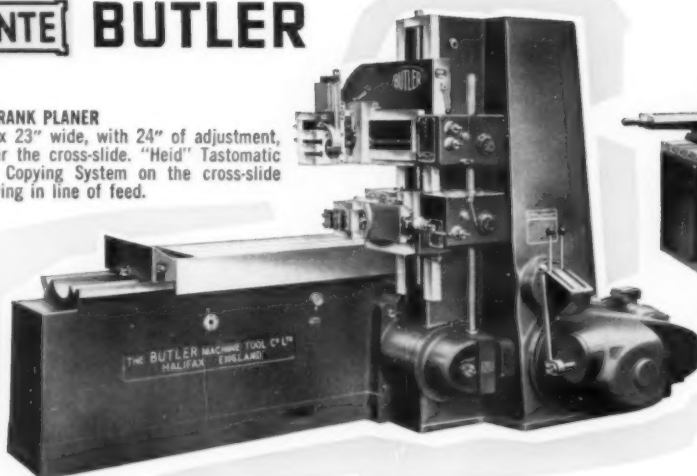
Super Shaper
Openside Crank Planer
Chucking Lathe
Engine Lathe
Ram Type Turret Lathe
Saddle Type Turret Lathe
Cylindrical Grinder
Automatic Internal Grinder
Surface Grinder
Gearbur Machine
Gear Planer
Universal Milling Machine
Automatic Copy Die Sinking Machine
Radial Drill
Horizontal Boring Machine
Rotary Positioner with Numerical Control

pictures inside ➡

LAPOINTE BUTLER

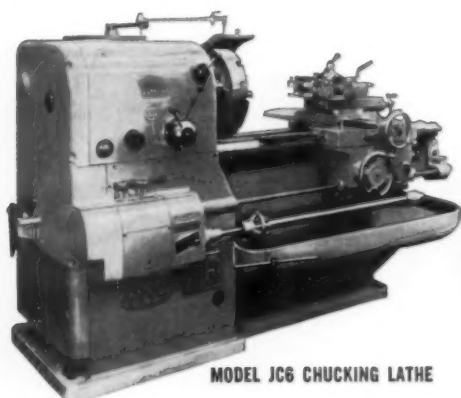
36" OPENSIDE CRANK PLANER

Table, 48" long x 23" wide, with 24" of adjustment, admits 24" under the cross-slide. "Heid" Tastomatic Electro-Magnetic Copying System on the cross-slide tool-box for copying in line of feed.

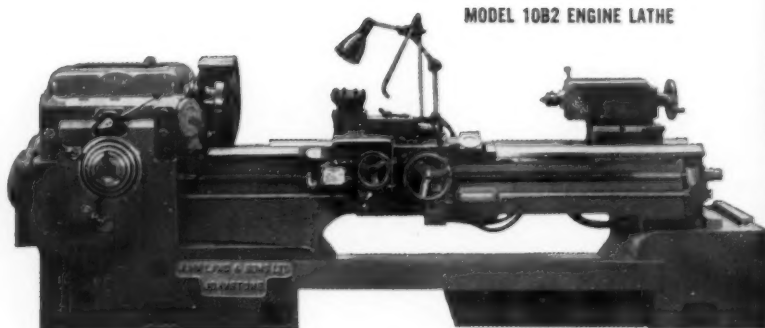


18" SUPER SHAPER

LAPOINTE LANG

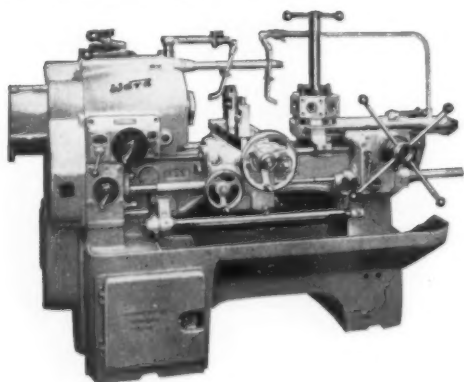


MODEL JC6 CHUCKING LATHE



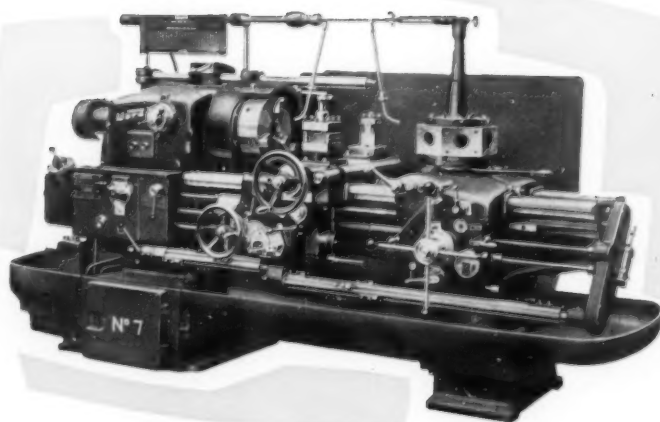
MODEL 10B2 ENGINE LATHE

LAPOINTE WARD



MODEL 3DS RAM TYPE TURRET LATHE

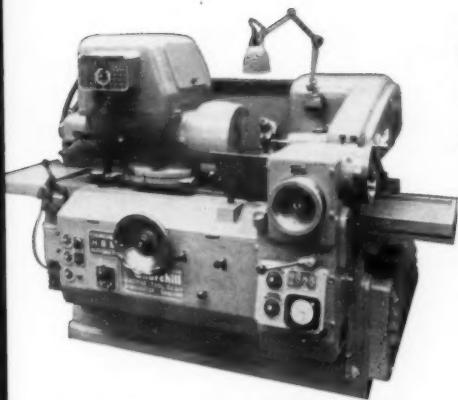
Height of center	7 1/2"
Diameter of hole through spindle	1 3/4"
Diameter of bar that automatic chuck will take	1 1/2"
Max. diameter that will swing over bed covers	14 1/2"
Number of spindle speeds in each direction	12



MODEL #7 PRELECTOR-SADDLE TYPE TURRET LATHE

Height of center	8 3/4"
Swing over stainless steel covers	16"
Diameter of chuck which will swing over cross-slide	9"
Diameter of chuck which will swing up to edge of cross-slide	12"
Diameter of hole through spindle	2 3/4"
Number of spindle speeds in each direction	12

LAPORTE CHURCHILL

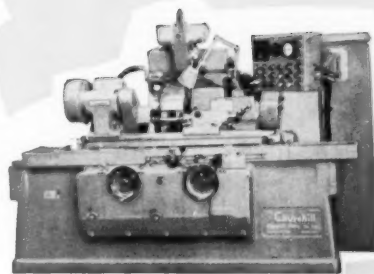


MODEL HBM AUTOMATIC INTERNAL GRINDER

Max. swing inside the guard	12"
Max. swing over table	19"
Max. traverse of work table	18"
Max. bore diameter ground	9½"



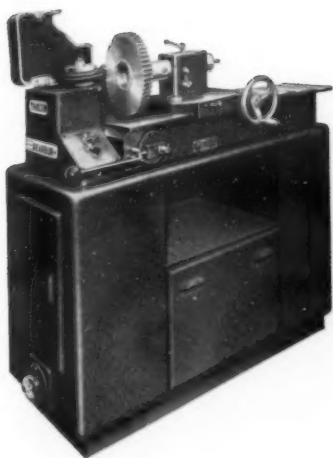
MODEL NB 6 x 18 SURFACE GRINDER
Demonstrating the "Rotaform"



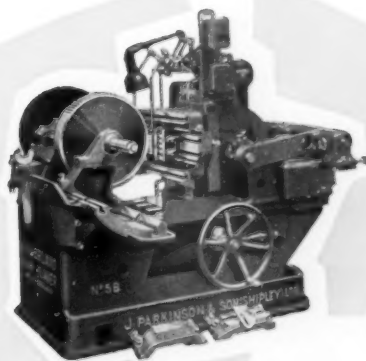
MODEL BW 10 x 36 CYLINDRICAL GRINDER

This machine is shown with diminishing feed mechanism, incorporating automatic wheel truing and compensation, together with automatic control of the machine cycle by electric sizing gage for plunge grinding work.

LAPORTE PARKINSON

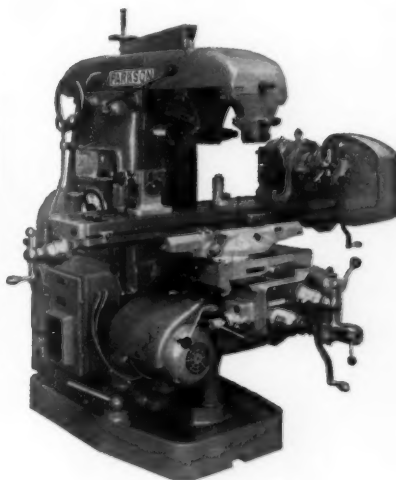


GEARBUR MACHINE



MODEL 5B SUNDERLAND GEAR PLANER
for Spur and Spiral Gears

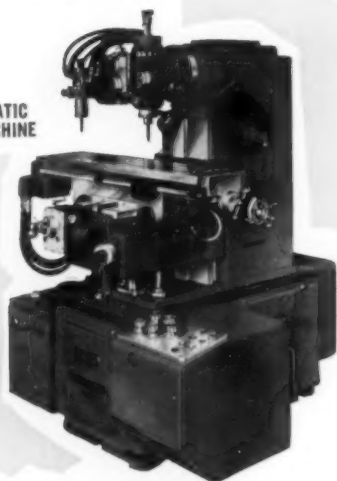
Will cut spur gears up to . . .	§ 24" dia. 4" face 5 D.P.— $\frac{1}{8}$ " C.P.
Will cut spiral gears up to a combination of 60°, $\frac{1}{8}$ " normal pitch, 24" face	
Greatest distance, end of spindle to outer support	16½"
Hole through spindle	1½"
Taper hole in spindle	No. 12B. & S.
Diameter of arbor	1¼"



**MODEL 2 NU UNIVERSAL
MILLING MACHINE**

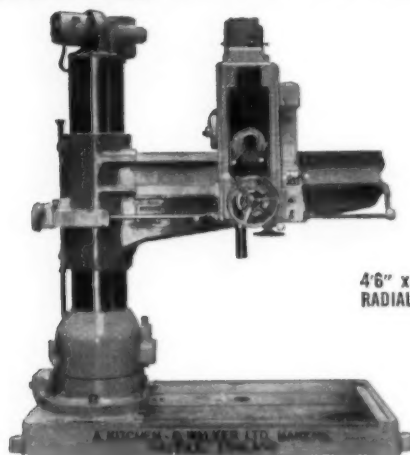
LAPOINTE HAYES

MODEL TM 43A AUTOMATIC
COPY DIE SINKING MACHINE



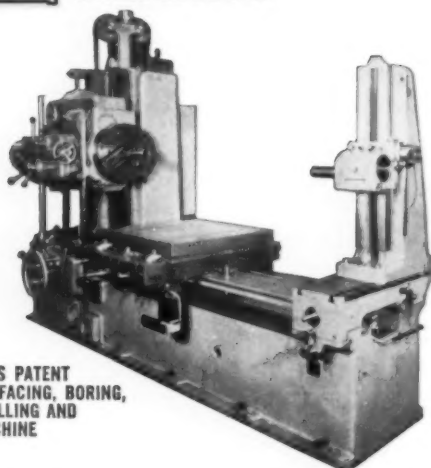
LAPOINTE KITCHEN-WALKER

4'6" x 14" COLUMN
RADIAL DRILL



LAPOINTE KEARNS

NO. 2 KEARNS PATENT
HORIZONTAL FACING, BORING,
MILLING, DRILLING AND
TAPPING MACHINE



LAPOINTE SPERRY/ORCUTT

ROTARY POSITIONER
WITH NUMERICAL CONTROL

Exceedingly high order of accuracy. Can feed instructions into the circular table as small as one-half second of arc movement (equivalent to about 35 millionths of an inch on the periphery).



All machines are available fully tooled, and backed up by the extensive Lapointe engineering, production and service personnel.

Other models and other capacities of these machines are available. Write for descriptive literature, and prices.

Address Department TE

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HUDSON, MASSACHUSETTS

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LAPOINTE
PRECISION
MACHINE
TOOLS

ASSEMBLE ACCURACY

into your special machines



HARTFORD
Special

Model 18-350

CAM FEED DRILL UNIT



EXTREME ACCURACY AND RIGIDITY... because rugged, unit-cast body assures precise alignment. Heat treated wear parts and precision ball and roller bearings used throughout.



FAST CYCLING... with multiple disc clutch and brake to engage and disengage feed train from spindle drive.



VERSATILE... because readily available commercial quick-change pick-off gears are used in feed train. Three



drive arrangements are available.



POSITIVE ACTION... and dependable performance through countless cycles. Closed cam design insures fast, positive quill return without use of springs.



DATA... 3½" stroke; 6000 rpm maximum spindle speed; 1000 pounds maximum thrust; 3 horsepower motor maximum.

FOR COMPLETE INFORMATION... write for Catalog No. 508.



At the same time, ask for information on Hartford Special's lines of Air Hydraulic Drill Units, including the all-new Model 17-400.

HARTFORD
Special

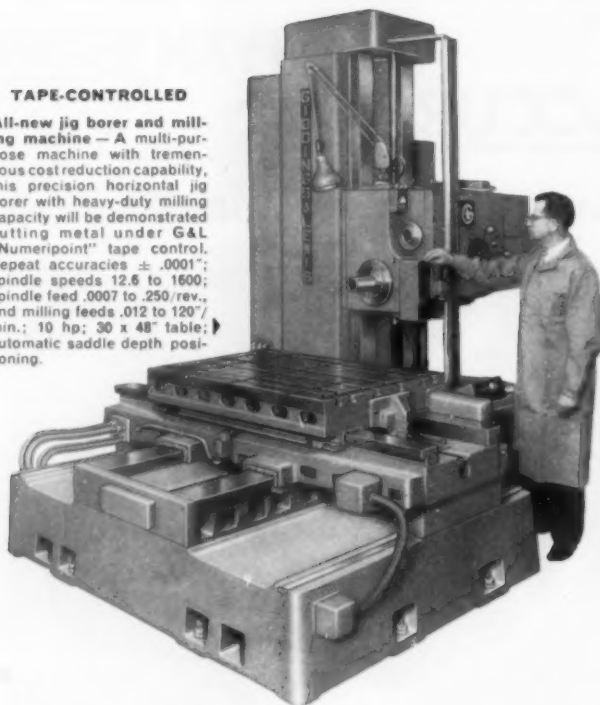
THE HARTFORD SPECIAL MACHINERY CO.

3800 College Highway, Simsbury, Connecticut

MMT=PE

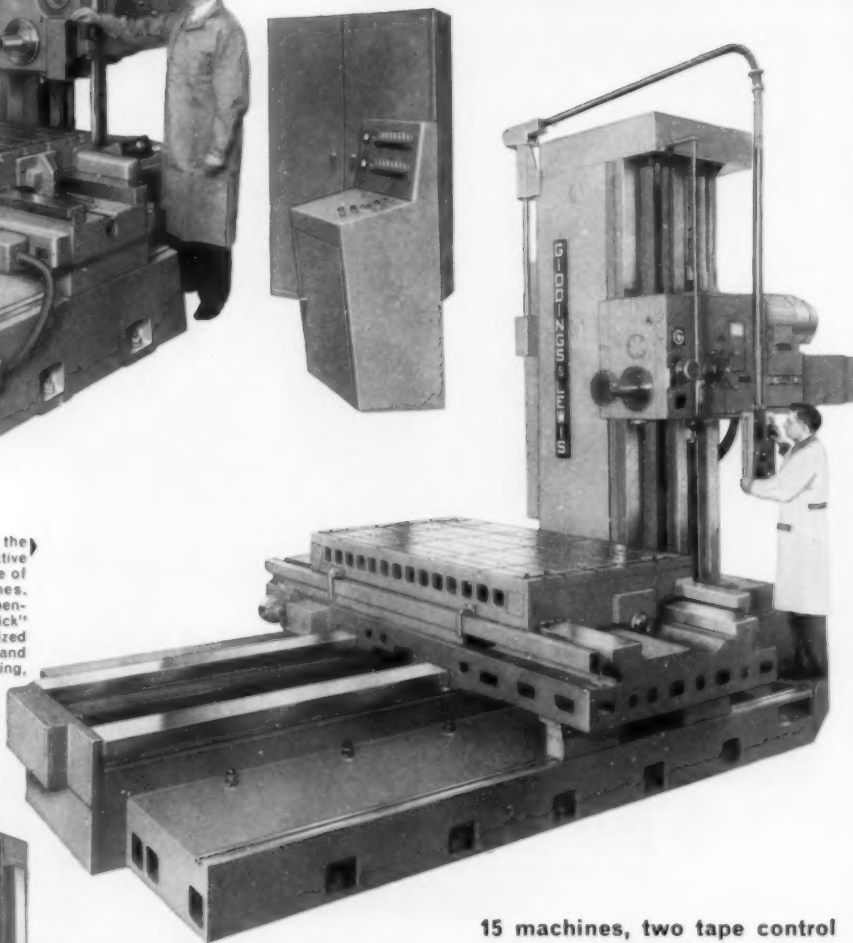
TAPE-CONTROLLED

All-new jig borer and milling machine — A multi-purpose machine with tremendous cost reduction capability, this precision horizontal jig borer with heavy-duty milling capacity will be demonstrated cutting metal under G&L "Numeripoint" tape control. Repeat accuracies $\pm .0001$; spindle speeds 12.5 to 1600; spindle feed .0007 to .250/rev., and milling feeds .012 to 120"/min.; 10 hp; 30 x 48" table; automatic saddle depth positioning.



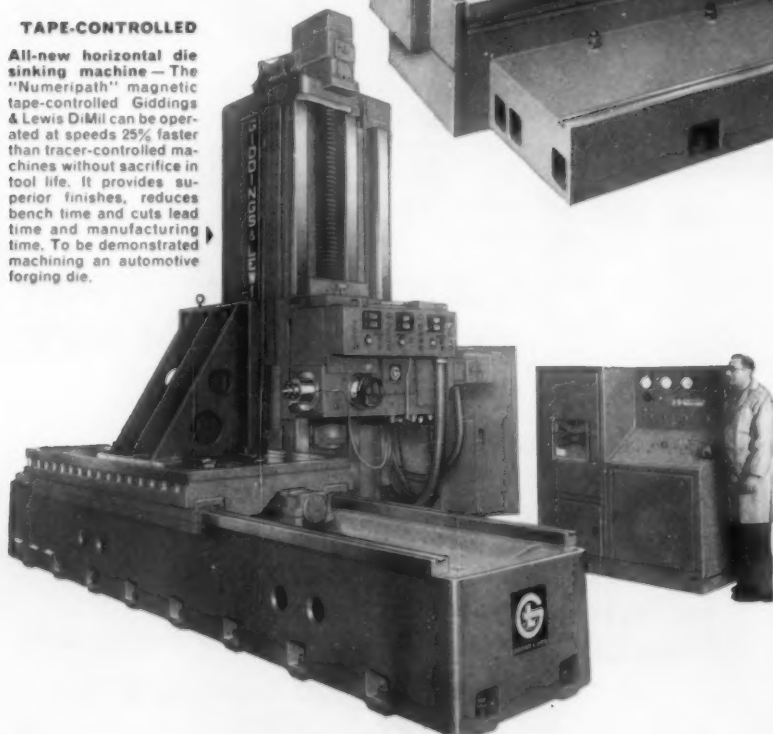
TAPE-CONTROLLED

All-new table-type horizontal built with the power and rigidity to make it the most productive machine in the history of the world's leading line of horizontal boring, drilling, and milling machines. Dozens of advanced features include complete pendant control of every machine function, "joy-stick" control of milling feeds, 3-way column, motorized headstock, independent and combination saddle and spindle feeds. To be demonstrated boring, drilling, and milling under "Numeripoint" control.



TAPE-CONTROLLED

All-new horizontal die sinking machine — The "Numeripath" magnetic tape-controlled Giddings & Lewis DiMil can be operated at speeds 25% faster than tracer-controlled machines without sacrifice in tool life. It provides superior finishes, reduces bench time and cuts lead time and manufacturing time. To be demonstrated machining an automotive forging die.

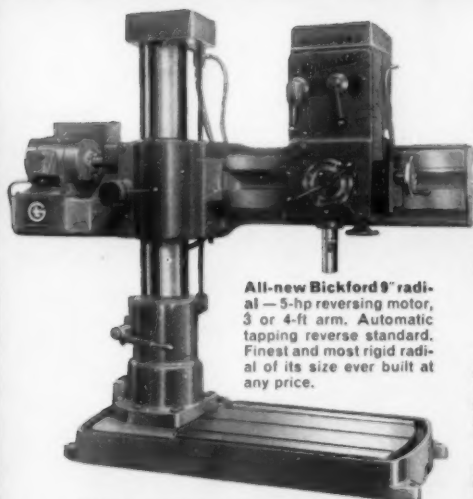


15 machines, two tape control systems in Giddings & Lewis \$1,000,000 display

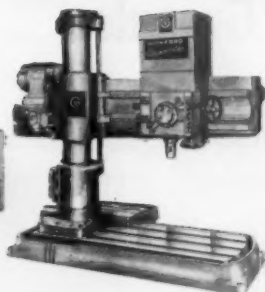
15 advanced design machine tools with a total worth of more than \$1,000,000 will be exhibited by Giddings & Lewis at the Machine Tool Exposition. All machines will be under power, five operated by G&L "Numeripoint" punched paper tape control, and one under G&L "Numeripath" magnetic tape path control. 12 machines will be cutting metal.

The capabilities of this equipment as compared to that built just a few years ago are almost unbelievable. Make a note now to see them in action!

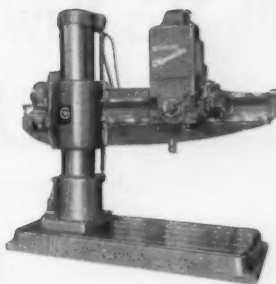
AT BOOTH NO. 1320!



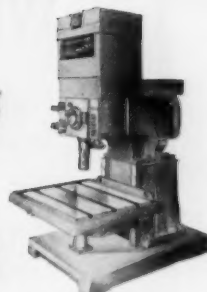
All-new Bickford 9" radial — 5-hp reversing motor, 3 or 4-ft arm. Automatic tapping reverse standard. Finest and most rigid radial of its size ever built at any price.



All-new 10-hp 11" Bickford radial — New heavy-duty head with pushbutton spindle control enables the operator to put more finished parts on floor.



Heavy-duty 15" and 19" Bickford radials — The exclusive capabilities of these machines will be demonstrated by tapping Class 3 threads, drilling 3" holes at .100" feed/rpm!



All-new Bickford 36" upright drill — This versatile 10-hp machine is a totally new concept in fast precision equipment for production and layout drilling. Features push-button operation.

TAPE-CONTROLLED

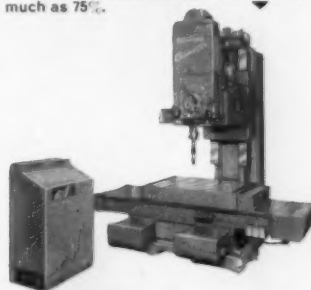
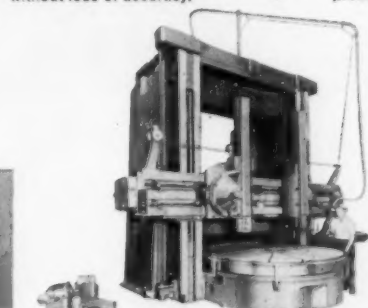
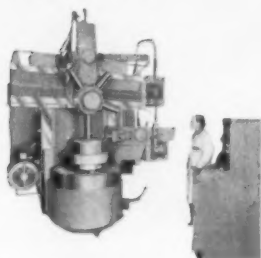
42" vertical turret lathe — An original G&L development that brings revolutionary economies to automatic small-lot machining. Table speeds, feeds, the five tools in turret head and four in side head are positioned by tape.

8-ft heavy-duty vertical boring mill — with full pendant control, roller bearing table track, and electronic readout measuring system. Operates continuously at carbide and ceramic tool speeds without loss of accuracy.

New 28" Bickford automatic cycling drill — A wide range of speeds and feeds in combination with automatic cycling and pushbutton control make this machine an outstanding producer on small lots or long runs.

TAPE-CONTROLLED

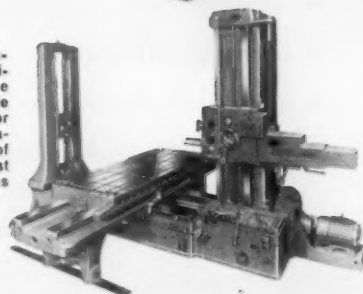
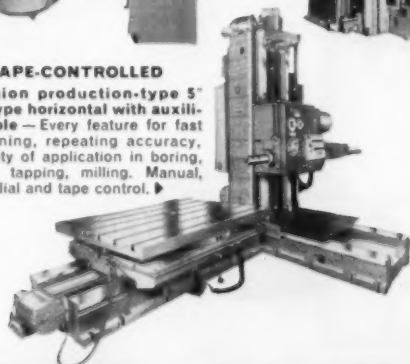
New high-speed positioning table and precision drilling machine — 360°/min 38" x 50" table with 5-ton capacity positions to $\pm .001$ ", repeats to $\pm .0005$ ". Drill features full preselection of 36 speeds, 18 feeds. Reduces floor-to-floor time as much as 75%.



TAPE-CONTROLLED

Precision production-type 5" floor-type horizontal with auxiliary table — Every feature for fast positioning, repeating accuracy, versatility of application in boring, drilling, tapping, milling. Manual, digital dial and tape control.

A new simplified manufacturing-type 4" horizontal featuring exclusive new zero positioning scale and many other items for operating ease and versatility that make it one of the fastest and easiest machines to run that has ever been built.



GIDDINGS & LEWIS

GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wis.

Jig borer and milling machines; horizontal boring, drilling, and milling machines; vertical turret lathes; vertical boring mills; positioning tables; die sinking machines; contour milling machines; radial and upright drilling machines; planers; planer mills; numerical and tracer control systems; Davis boring tools.

Use Reader Service Card, CIRCLE 39

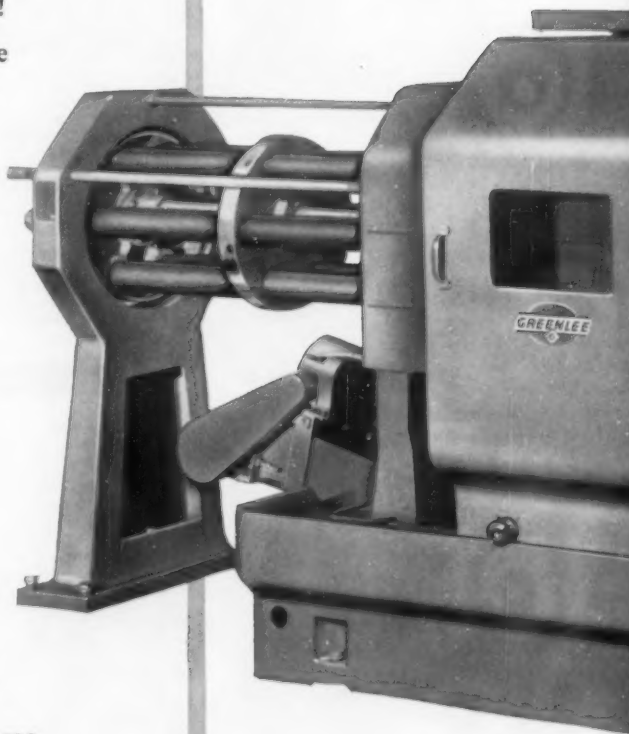
Now . . . 3½" Capacity With This New Greenlee

Biggest of the Greenlee Bar Automatics!

This new 3½"—6 spindle model offers the most outstanding advantages in the field.

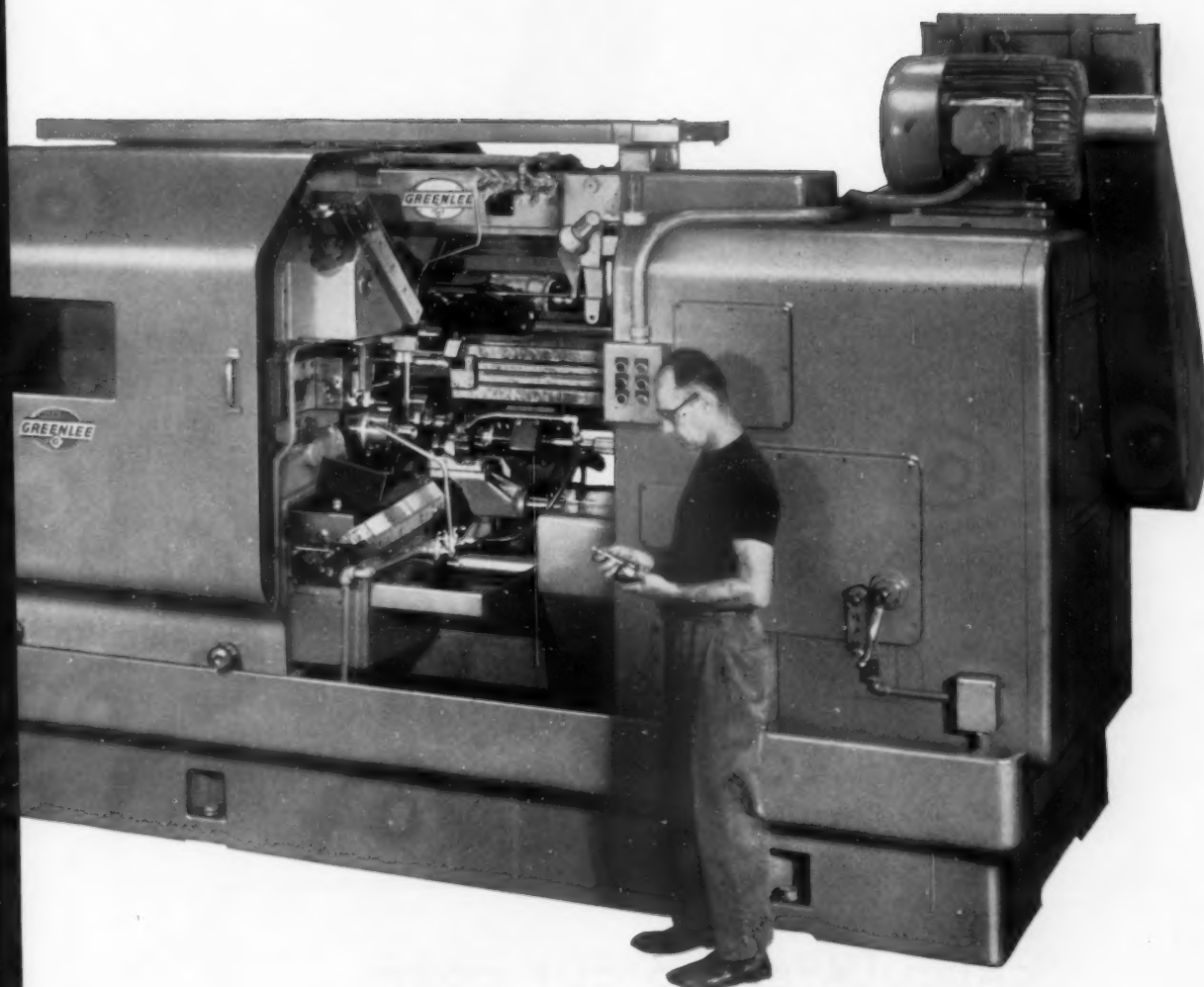
It is exceptionally versatile. It offers well-known Greenlee dependability. Like all Greenlee Automatics it has independent, cam-operated cross slides and a wide-open tooling area. Greater flexibility, accuracy and productivity are built into this big, powerful Greenlee Automatic. Check these outstanding advantages:

- Permanently Aligned Spindle Carrier
- Positive, High-Speed Carrier Indexing
- Wide-Open, Easily Reached Tooling Area
- Sturdy, Cam-Feed Main Tool Slide
- Interchangeable Cross Slide Camming
- Micrometer Adjustment On All Cross Slides
- Rapid-Shift, Dual-Range Speed and Feed Gears
- Built-in Lead Screw Threading Feed and Drive



Other Greenlee 6 Spindle Bar Automatics are offered in 1", 1½", 2" and 2½" capacities.

TRANSFER MACHINES • SPECIAL MACHINES • SIX AND FOUR SPINDLE AUTOMATICS • TRIM PRESSES



GREENLEE BROS. & CO.
1938 MASON AVENUE, ROCKFORD, ILLINOIS

DIE CASTING MACHINES • WOODWORKING MACHINES AND TOOLS • HYDRAULIC AND HAND TOOLS
September 1960 Use Reader Service Card, CIRCLE 41



CALCULATED TO CUT COSTS

CARD gages, like forms in geometric progression are duplicated with consistent accuracy. Precise duplication like this can help you save production time and money. Get the gages you need from your CARD Distributor, who carries a full line of gages, taps, dies, and screw plates. And get expert advice on their selection and use from your CARD technical man. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.



CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast



GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

Geometric progression sets the pattern for producing UNION cutting tools. That's why each UNION end mill of the same type and size is precisely duplicated. To users this assures consistently better performance and longer service life. Add these benefits to your own production by specifying UNION end mills, drills, reamers, milling cutters, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.



UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts
S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.



LARGE LAMINATING TOOL

MADE AT 80% SAVINGS

using BAKELITE epoxy resin-glass cloth laminate

You gain two distinct advantages when tools are made with BAKELITE epoxy resins. Tools can be produced rapidly, and they result in substantial savings in cost.

The Tapco Group of Thompson Ramo Wooldridge, Inc., has dramatically proven the merits of epoxy laminate tooling. A parabolic shaped laminating tool—approximately 15 feet long and seven feet across—*was made and placed in production in a minimum amount of time.* In addition, it has a smooth and flawless surface, producing parts with no detect-

This Laminated Epoxy Resin-Glass Fiber Tool is used to shape sectors of a convex epoxy-glass part, each measuring about 14 by 6 feet. The low-cost tool was built of BAKELITE epoxy resins laminated with glass fibers by Cleveland Standard Pattern Works for the Tapco Group of Thompson Ramo Wooldridge, Inc. The epoxy resin compound was formulated by Rezolin, Inc., Los Angeles, California.

able distortion. The company claims the epoxy-glass tool saved approximately four-fifths of the estimated cost of a laminating tool made from other materials.

If you are concerned about your present tooling expenses, investigate epoxy resin-glass fiber combinations. See your local technical representative, or write for information to Dept. CV-141, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York.



BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

Bodine

CASE HISTORY No. 53

A PROVEN BODINE MONEY-MAKING FORMULA



Very special production advantages achieved with very little engineering

This high quality cast BX cable connector is still strictly a volume production job . . . to be processed at absolute minimum cost. Bodine's solution to the problem has reduced FIVE separate handlings to ONE, with a single Bodine machine performing 6 operations and two inspections at 25 strokes per minute . . . 11,250 total operations per hour.

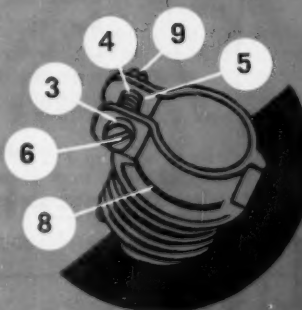
Yet this is not, in the usual sense, a "special" production unit. It is a standard Bodine Basic 41-20 machine with standardized Bodine equipment and tooling that involved very little engineering except for the dial plate. Substantial production savings are matched by equally substantial initial cost and time savings. Advantages include RAPID CHANGEOVER to many similar operations . . . a "complete production line" for these products in a few square feet of floor space.

This is just one current example of Bodine time and cost-saving approaches to today's urgent cost-cutting needs. Let's apply the same thinking to your problem. Write Dept. TE-9 today.

PRODUCTION: 25 strokes per minute. 1250 pcs/50-min. hour. 11,250 operations/50-min. hour.

THE OPERATIONS . . .

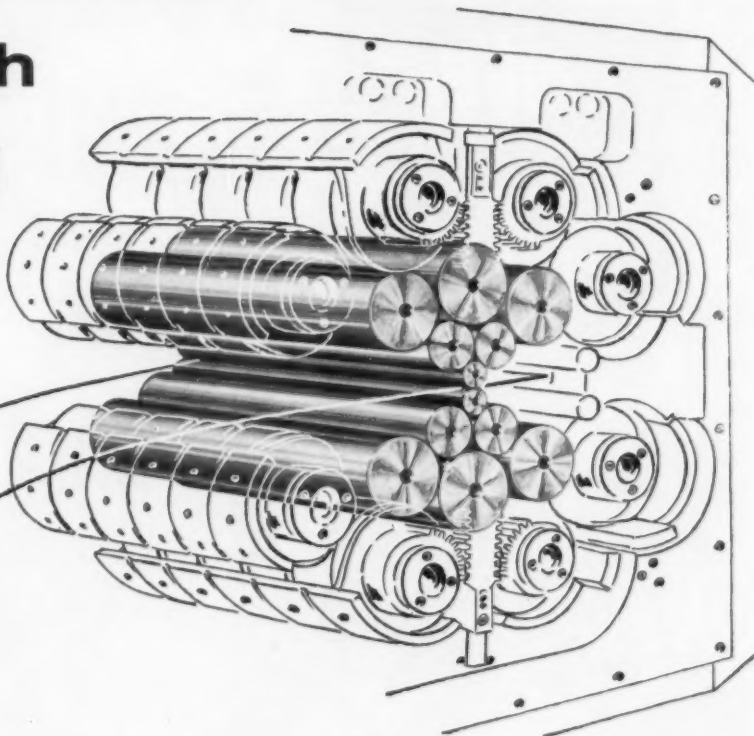
1. Manual load piece to "nest" in dial.
2. Auto inspect for correct position.
3. Drill top ear (clearance drill).
4. Drill bottom ear (tap drill).
5. Tap bottom ear.
6. Insert clamp screw (auto feed).
7. Auto check position of screw.
8. Mill flexing-slot in top ear.
9. Stake screw to prevent falling out in plating and shipping.
10. Auto eject.



BOOTH NO. 828
The Machine Tool Exposition — 1960

3BD60

How UDDEHOLM Solved A Tough Tool Steel Problem



Sendzimir Mill Work Rolls, to impart that high finish to cold-rolled material, must, themselves, have an extremely fine surface finish.

The Problem—Produce a “clean” steel for high pressure and high speed cold rolling application.

The Solution—UHB “Tri-Z”, a high carbon, high chromium steel with an absolute minimum of non-metallic inclusions.

Uddeholm metallurgists solved the problem by starting with the purest Swedish ores, having very low sulphur and phosphorous content. Then, they used extreme care in refining, a special pouring technique and quality controls to the highest standards. Because of its “cleanness”, its ability to take an exceptionally high finish and stand up under high pressure and high rolling speed, “Tri-Z” is the criterion for Sendzimir Mill Rolls.

All Uddeholm Tool Steels, whether for standard or unusual applications, adhere to the same high quality standards. You can choose from more than 2800 combinations of grade, shape, size and finish. Contact your nearest Uddeholm Specialty Steel Service Center—Newington, Conn., New York City, Cleveland, and Los Angeles, where experienced “steel men” will help you select the right tool steel for your needs. At Uddeholm you have an unbeatable combination for quality and delivery.

Write or call on Uddeholm for your tool steel needs.



UDDEHOLM COMPANY OF AMERICA, INC.

155 East 44th Street, New York 17, N. Y. • Murray Hill 7-4575

BRANCH OFFICES AND WAREHOUSES

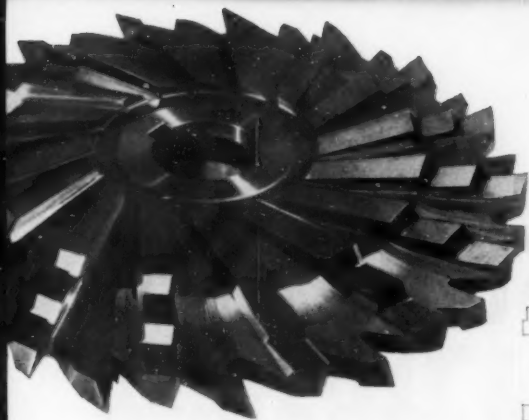
Chicago, Ill. • Cleveland, Ohio • Detroit, Mich. • Los Angeles, Calif. • Newington, Conn. • Philadelphia, Pa.

TOOL STEEL WAREHOUSE DISTRIBUTORS

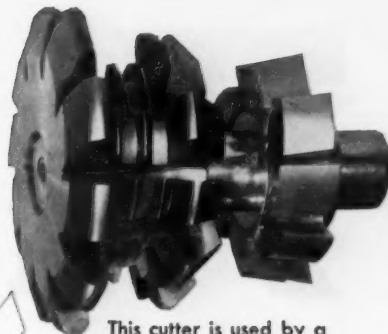
Rockford, Ill. — Rockford Industrial Steel Service • Utica, N. Y. — Pacemaker Steel and Aluminum Co.

IN CANADA • Uddeholm (Canada) Ltd. • Montreal • Toronto

TOOL AND DIE STEELS
COLD ROLLED SPRING
STEELS



A special multiple-step milling cutter used by steam turbine manufacturer to cut stepped rotor slots for turbine blades.



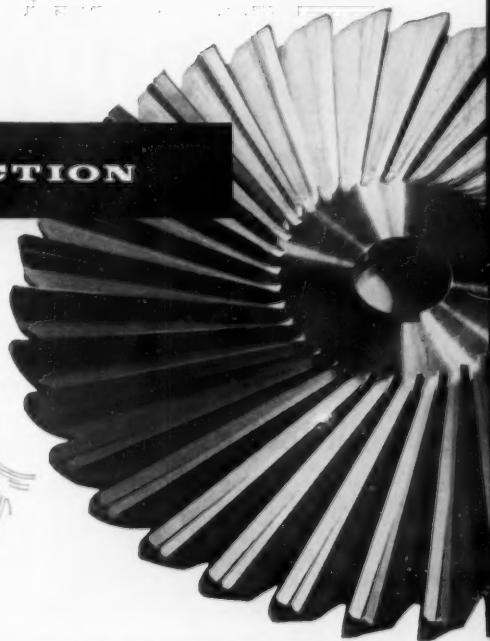
This cutter is used by a prominent saw manufacturer to form mill the profile in dado blade sets for the wood working industry.

HOW TO GET THE MOST

OUT OF HIGH SPEED PRODUCTION

MILLING MACHINES

This tapered multiple thread mill cuts threads in pipe joints used in oil well drilling operations.



A special milling cutter for sweep milling impellers used in air conditioning and jet engine sections.

Illinite® Special Milling Cutters, like those shown here, speed production and cut costs two ways:

(a) Illinois Tool applied metallurgy assures long, efficient tool life through proper material selection, forging and heat treatment *tailored to your specific application.*

(b) Illinois Tool engineering job-tailors your special milling cutters for maximum efficiency. ITW tool designers often combine several machining operations into a single cutter or

gang, with consequent savings of considerable time per piece. Specially designed tools such as these also assure improved accuracy *since accuracy is designed into the tool*, and is not dependent upon several separate operations.

Why not get the most from *your* high speed production machines. Ask your Illinite distributor about job-tailored milling cutters today! Remember, he also carries a complete stock of standard cutters for prompt delivery.



Write today for this helpful new booklet on Metallurgy in Tool Design and Production.



ILLINOIS TOOL WORKS

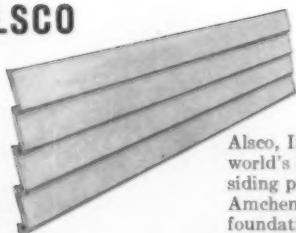
TOOL & INSTRUMENT DIVISION
2501 N. KEELER AVENUE • CHICAGO 39, ILLINOIS

Your ILLINITE distributor is just a phone call away.

Use Reader Service Card, CIRCLE 47

7 of the finest in the field specify

ALSCO



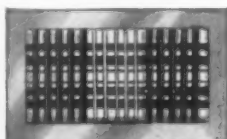
AlSCO, Inc., one of the world's leading aluminum siding producers specifies Amchem Alodine® as the foundation for a successfully painted, durable aluminum surface.

GENERAL BRONZE



The Alwintite Division of General Bronze Corp. specifies Amchem Alodine and Amchem Aluminum Etchant for a superior, long lasting finish on their popular line of residential aluminum windows.

KRUEGER



Krueger Air Conditioning Corp. specifies Amchem Granodine® for superior pre-paint protection and paint adhesion on steel registers, grilles and diffusers for air conditioning and heating.

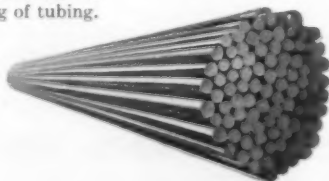
HANOVER



Hanover Wire Cloth Division of Continental Copper & Steel Industries specifies Amchem Alodine as the base for their line of non-glare, corrosion-resistant, color-fast aluminum screening.

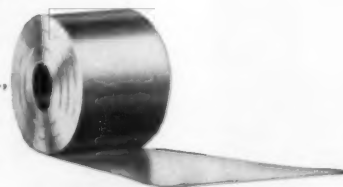
WALLINGFORD STEEL

Wallingford Steel Company, one of the world's largest producers of stainless steel tubing, specifies Amchem Granodraw SS® to facilitate forming of tubing.



CAROLINA METALS

One of the country's top painted aluminum strip processors, Carolina Metal Products Corp., specifies Amchem Alodine for continuous strip pre-paint treatment of aluminum.



AMCHEM for the finest in paint bonding and coating chemicals

BOEING AIRCRAFT



Internationally known Boeing Aircraft Co. specifies Amchem Alodine as a pre-paint treatment, and to treat unpainted portions of the famous 707 jetliner fuselages and engine pods.

If you're looking for superior corrosion resistance, paint bonding and coating performance . . . write for complete information on these and other Amchem chemicals for the metalworking industry.



Amchem, Alodine, Granodine and Granodraw are registered trademarks of

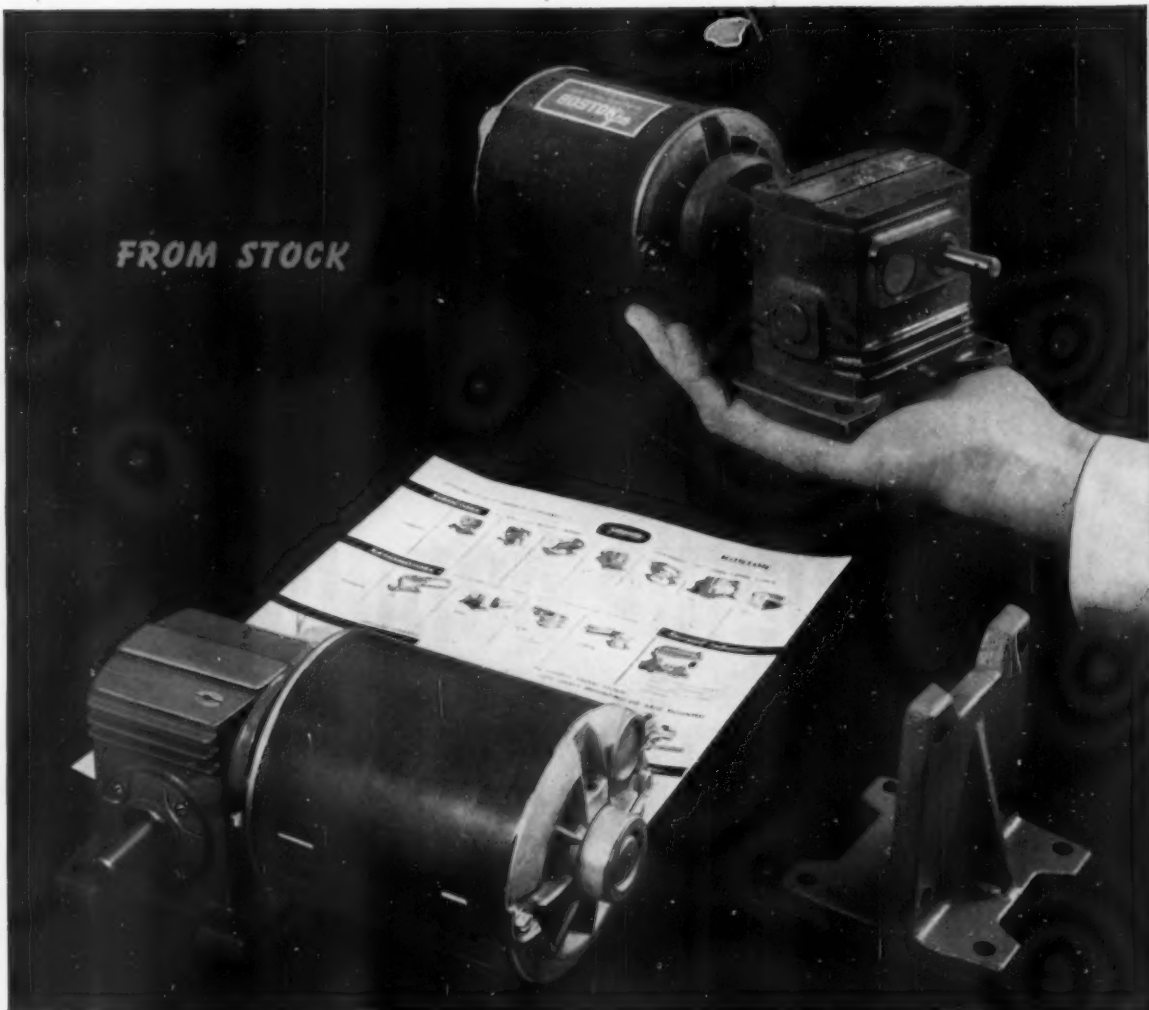
AMCHEM PRODUCTS, INC.

(Formerly American Chemical Paint Co.)

AMBLER, PA.

Detroit, Mich. • St. Joseph, Mo. • Niles, Calif. • Windsor, Ont.

FROM STOCK



THE NEW M109 Ratiomotor (foreground) for horizontal right angle drives is furnished with 1/20 hp or .035 hp motor. Output speeds range from 43.8 to 350 RPM. New standard mounting bracket shown

permits easy mounting in many positions. The NEW MW109 (in hand), for horizontal parallel drives, is also furnished with 1/20 hp or .035 hp motor. Output speeds range from 1.9 to 70 RPM.

NEW Ratiomotors meet demand for BOSTON Gear efficiency in "pint-size" power packages

Now, you can get BOSTON Gear quality and lasting economy in speed reducers for drives as low as .035 hp. Two new units, designed for space-saving, provide a wide range of output speeds.

When you need worm-gear reducers, you'll find any type and ratio you want in

the big line of over 1600 BOSTON Gear 100 Series Reducers and Ratiomotors . . . and you can get it FROM STOCK. Catalog No. 57, with the NEW PRODUCTS Supplement, lists full information. Get your copy. Boston Gear Works, 83 Hayward St., Quincy 71, Mass.

Advt. copyright by Boston Gear Works

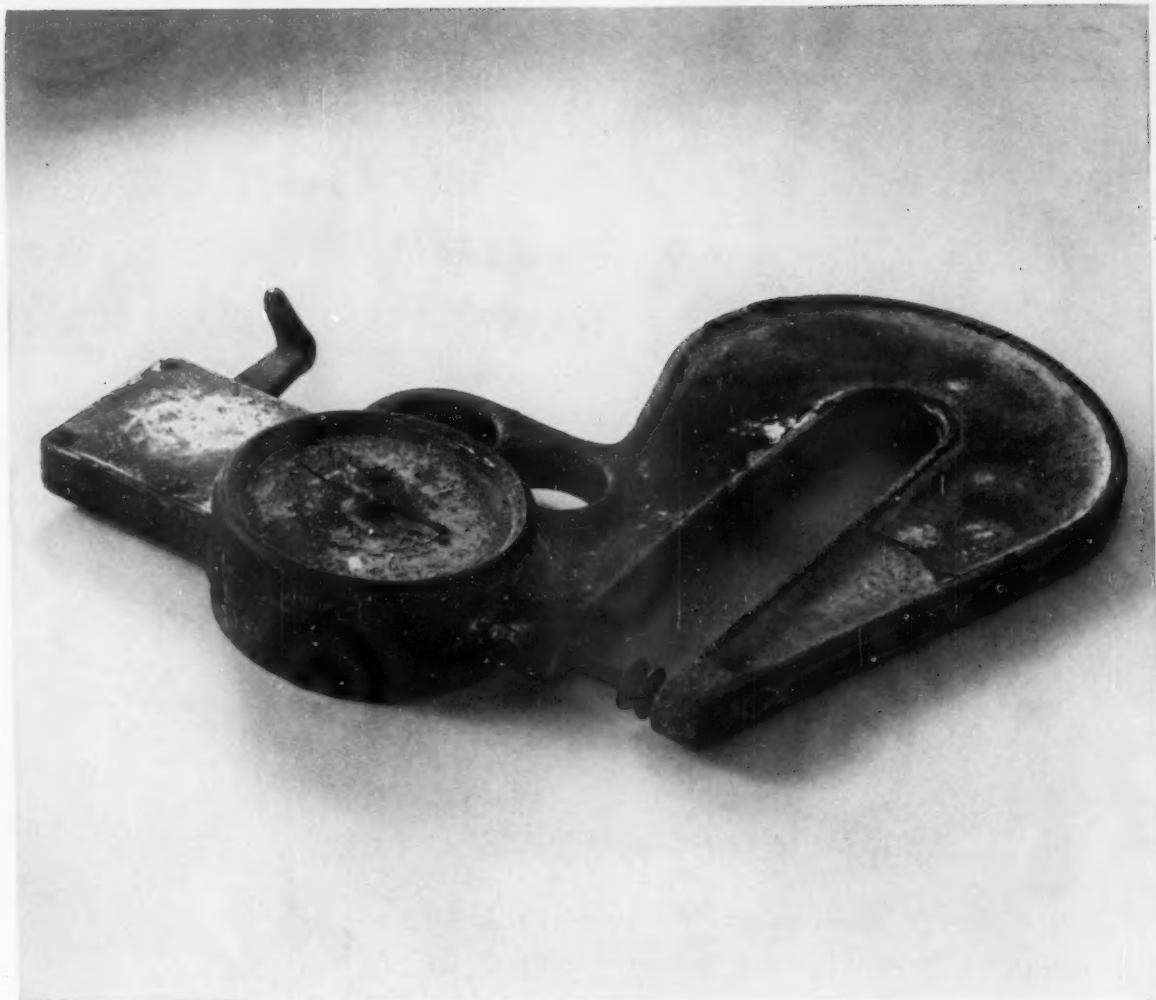


CALL YOUR
NEARBY **BOSTON Gear**
DISTRIBUTOR

— STANDARDIZATION PAYS —



Ask Distributor for
NEW PRODUCTS
SUPPLEMENT
to Catalog No. 57



A gage we'd be proud to put in any show

There had been no accident.

This Federal thickness gage — baked to a crisp, dial obliterated, crystal gone, hand bent, parts missing, was still on the job checking hot sheets in the rolling department when it was returned for renovation.

No accident that it could still do its job under conditions that would have long since retired a lesser gage. Proper design and good

workmanship give Federal gages the workhorse durability that makes them regularly outperform and outlast other gages.

Quality is so important in gaging. Relying on design and experience is much more economical than buying on price.

Do you have our catalog?

Write Federal Products Corporation, 6199 Eddy Street, Providence 1, Rhode Island.

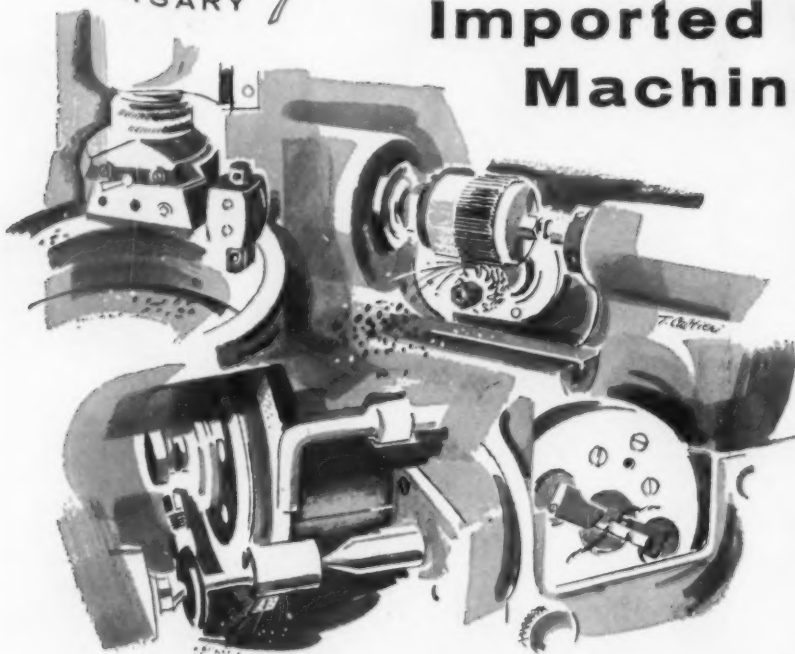
Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES...

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging



Your Largest Selection of Imported Precision Machine Tools



**See them in operation—Booths 117 & 653
Coliseum Machinery Show—Sept. 7-15**

Cosa will exhibit many of the latest designs in Precision Production Machine Tools. Featured in Booth 653, you will see a new **Deckel LK** with interchangeable heads for Jig Boring and Jig Grinding. There will be a new Coil-fed **Escomatic D-4** form-turning machine, automatically producing small precision parts—centered and drilled to reduce secondary operations. A **Schenck R06** Balancer, with autocycling, will precisely balance small parts revolving at 10,000 to 30,000 rpm. Two **Studer** Universal and Cylindrical Grinders, models RHU 450 and RM 250L, will grind parts to extremely close tolerances. Both Studers can be equipped with O.D. grinding and match grinding measuring devices for automatic sizing, spark-out control and machine shut-off. The RM 250L, a one-lever controlled grinder, is being shown for the first time in this country. A **Koepfer** Gear Hobber 170 for automatic production of various types of gears will also be demonstrated.

In Booth 117, two **Trumpf** Universal Sheet Metal Working Machines will demonstrate copy-nibbling, many curve cutting and forming operations.

Expert technicians will demonstrate these machines and provide information on the entire Cosa line, listed at the right.

CHECK COSA'S COMPLETE LIST FOR YOUR TOOLING NEEDS

- Balancing Machines
- Bending and Forming Machines
- Boring Machines
 - Boring, Milling
 - Horizontal
 - Jig
 - Special
 - Vertical
- Chucking Machines
- Drilling Machines, Radial
- Dynamometers
- Engraving Machines
 - 2 & 3 Dimensional Pantograph
- Fatigue Testing Machines
- Flow Forming Machines
- Gear Checking and Testing Machines
- Gear Hobbers
- Grinding Machines
 - Cam & Contour
 - Centerless
 - Cylindrical, Plain
 - Internal
 - Jig
 - Profile
 - Surface
 - Tap, Tool & Cutter
 - Thread
 - Universal
- Jig Boreers
- Lathes
 - Copy Turning
 - Double End
 - Facing
 - Roll Turning
 - Special
 - Spinning
 - Tracer
 - Turret, Vertical
- Milling Machines
 - Contour
 - Die Sinking
 - Horizontal
 - Planers
 - Profile
 - Skin
 - Special
 - Universal
 - Vertical
- Nibbling Machines
- Planers, Open Side
- Rack Cutters
- Roller Shears
- Screw Machines, Swiss, Coil-Fed
- Transfer Presses

COSA

**Importers of Leading Precision Machine Tools
Nationwide Sales and Service
COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.**

WHITMAN & BARNES
MAKERS OF FINE TOOLS SINCE 1848
DRILLS AND REAMERS



which drill really costs less?

Based on results, drills "A" and "B" (center and right, above) should cost 43% and 39% less than W & B drills (left, above)—instead, they can be purchased at *only* about 20% less.

Watch those *initial* costs—they may be *costly*!

COMPARATIVE DRILLING PERFORMANCE

General Purpose Jobbers Drills	*No. of holes per drill size					Total No. of Holes	Efficiency Rating
	#40	#30	3/16"	1/4"	5/16"		
W & B Drills	208	62	57	50	34	411	100%
"A" Drills	142	24	14	28	28	236	57%
"B" Drills	114	49	13	61	15	252	61%
Thickness of plate	3/32"	3/16"	1/2"	1"	1"	Material: Heat treated chrome nickel steel	

*In each drill size, five drills of each brand were tested and each drill was resharpened three times as required.



PARTNERS IN PRODUCTION PROGRESS

Many drill performance tests similar to this one have been made. However, W & B will gladly conduct drill tests at *your* plant and under *your* conditions. Contact us direct or through your W & B distributor. He can offer this service plus fast delivery from complete stocks.

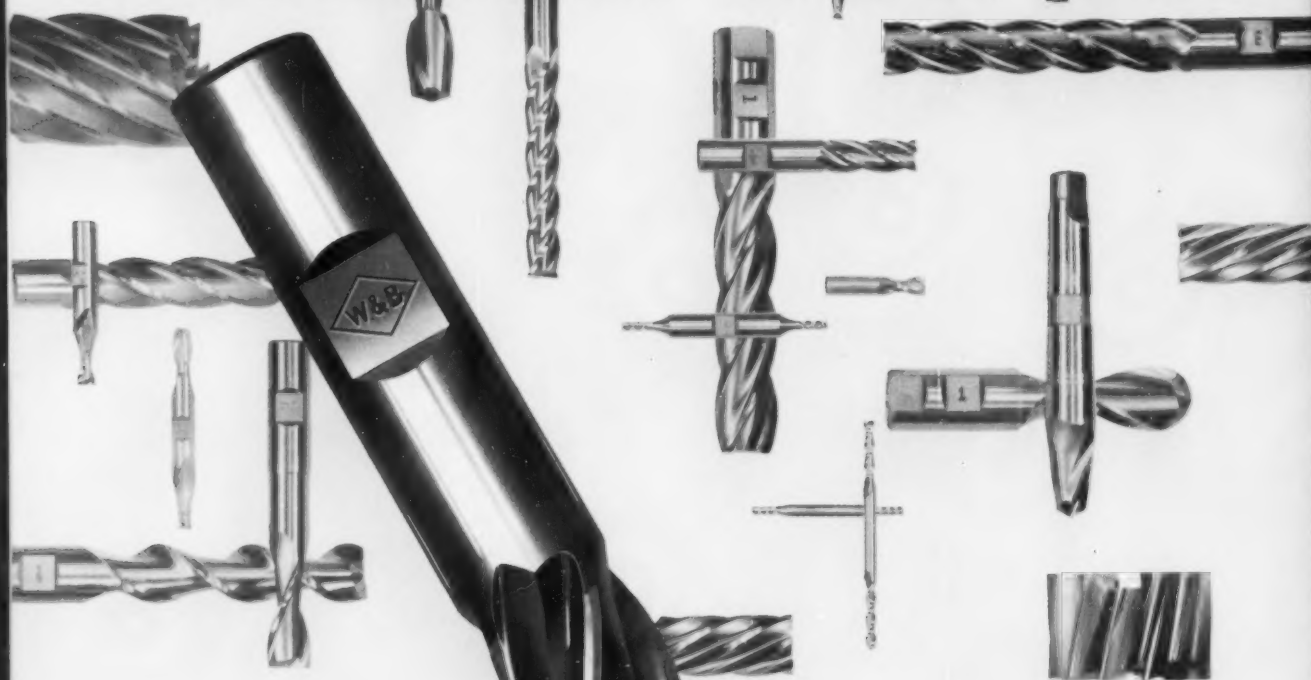
WHITMAN & BARNES

40000 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN

DRILLS • REAMERS • END MILLS • COUNTERBORES • COUNTERSINKS • CARBIDE TOOLS • SPECIAL TOOLS

W & B END MILLS

Designed Better To Mill Better



1 Newly designed flute shapes afford maximum cutting performance at higher rates of feed.

2 Flutes are machine polished—pockets are eliminated. Chips are easily cleared, assuring a free cutting action.

3 New clearance and precise polishing of flutes provide greater accuracy and control of size.

4 Sharp corners and stress points have been eliminated to provide greater strength, less breakage.

5 New style clearance strengthens cutting edges, prevents flaking or chipping.

6 New flute shapes and chip clearing ability reduce wear on cutting edges.

Every Feature Says Compare!

Try W & B end mills on your milling operations . . . a comparison will demonstrate their superior performance. Your local W & B distributor carries a complete stock of standard, off-the-shelf types

and sizes. He offers you the best in service and delivery on end mills for any standard application—so, to make your own performance comparison, call your industrial distributor today!



PARTNERS IN PRODUCTION PROGRESS



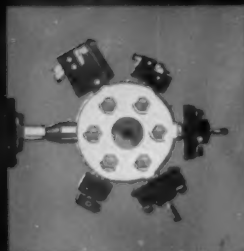
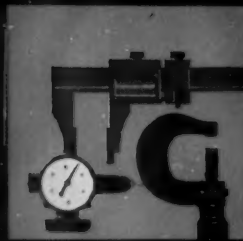
WHITMAN & BARNES

MAKERS OF FINE TOOLS SINCE 1881

DRILLS AND REAMERS

40000 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN
NEW YORK CHICAGO LOS ANGELES

DRILLS • REAMERS • END MILLS • COUNTERBORES • COUNTERSINKS • CARBIDE TOOLS • SPECIAL TOOLS



See what's NEW at Booth 452

to help you
make more
for less...

Brown & Sharpe
PRECISION CENTER

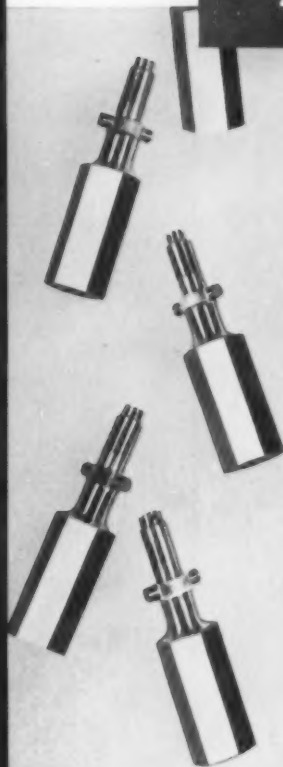


MACHINE TOOL
EXPOSITION
1960



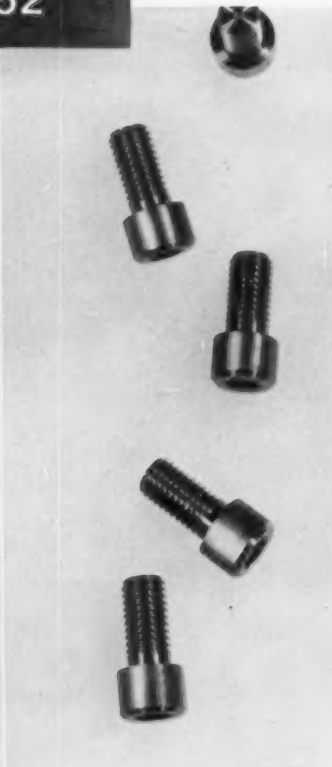
See what's
new
at Booth
452

TO HELP YOU MAKE MORE
FOR LESS WITH SCREW MACHINES



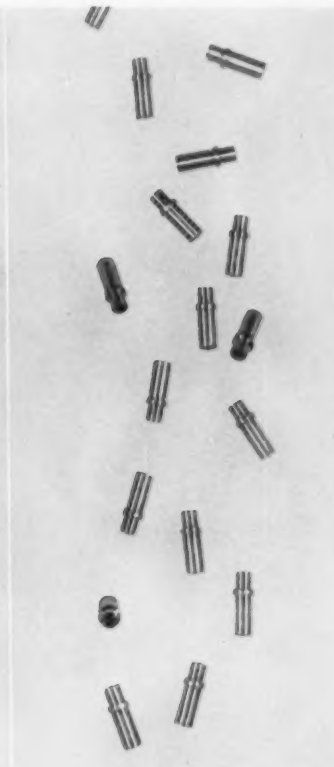
NEW fourth slide
permits added
operations in cycle

Upper front forming slide has 2 tool holders for turning right or left hand. At upper back is cut-off slide. Both slides are interchangeable.



NEW drilling & broaching
attachment extends
work range

Picks up cut-off piece, drills back end and punch broaches with 18,000 lb. pressure (generated from 80 lb. air). Or, broaches front end.



NEW electronic gaging
holds closer tolerances

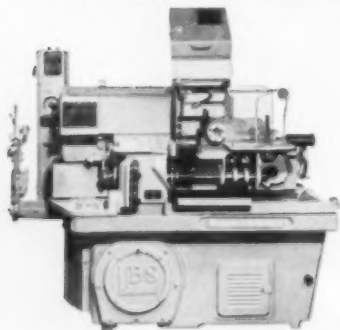
Comparator checks each part from transfer mechanism — shuts off feed at first bad part. Operator resets tools fast by observing "over-under" lights.



NEW faster feeding
boosts small diameter
parts production

10,000 rpm provided in bar feed mechanism by auxiliary that stops spindle liner momentarily when stock is fed. Eliminates centrifugal problems.

Brown & Sharpe Automatics show dramatic progress in output speed, accuracy, and adaptability



New-design advantages like these in Brown & Sharpe's new Automatic Screw Machines can boost your production rates as much as 100%. Brown & Sharpe is constantly at work improving Nos. 00, 2 and 4 Automatics — to save you money — to give you even better precision and finish — to increase machine adaptability for different types of work.

These four examples of continuing B&S design leadership will be dramatically demonstrated at Booth 452. Stop in and see for yourself why plants that replace old equipment with new B&S automatics can write off the investments in record time, with daily dollar savings. Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

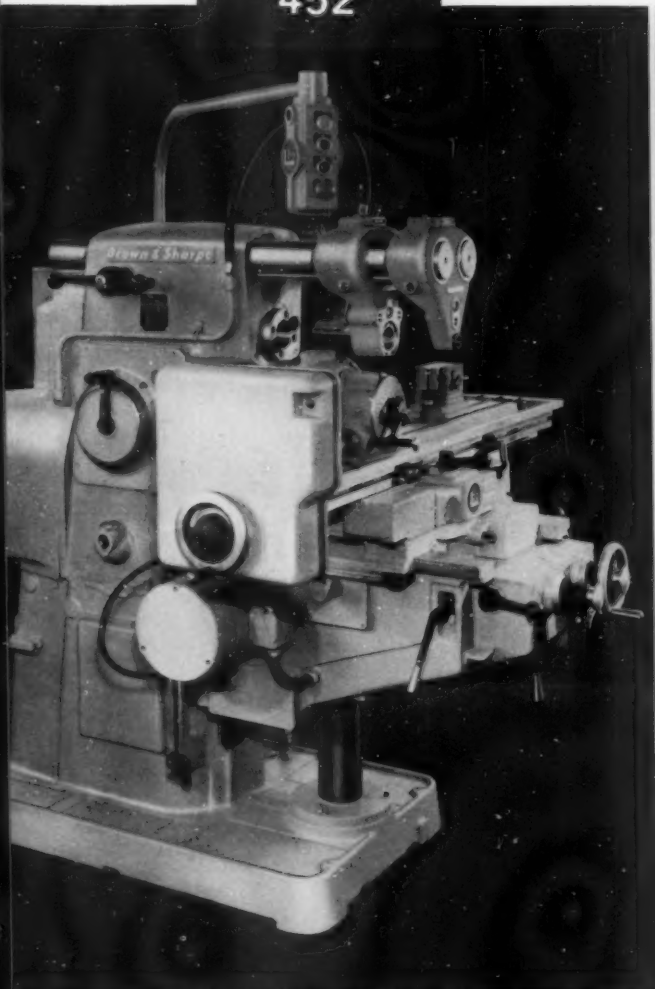
Brown & Sharpe  **PRECISION CENTER**

Use Reader Service Card, CIRCLE 55

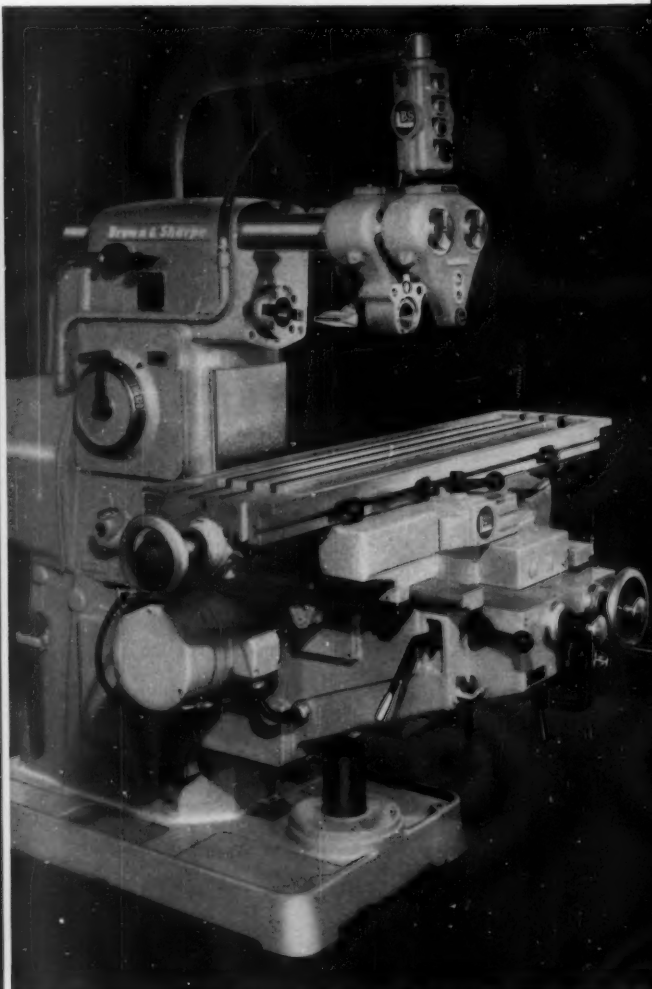


See what's
new
at Booth
452

TO HELP YOU MILL MORE FOR LESS



NEW B&S No. 2 Universal Milling Machine



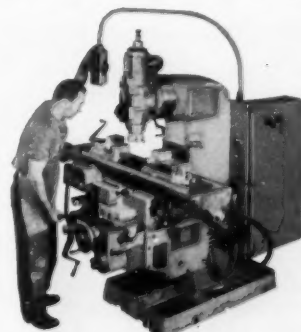
NEW B&S No. 2 Plain Milling Machine

Introducing 14 new B & S DYNAMASTERS - No. 2 Plain, Universal, Vertical; and Rangemasters - 3, 5, 7.5, 5/10 hp

You'll see something new from every viewpoint in the B&S No. 2 Milling Machines on display in Booth 452. And, whatever your specific needs, you'll see why the new series provides every feature you want for top efficiency and economy in your milling operations. Construction with standard units offers a choice of 132 cost-cutting combinations, permits you to select a machine "custom built" to your needs, ready for prompt delivery. The B&S Rangemaster® sliding head type machine, also exhibited, incorporates many of the same advantages.

You'll also see the B&S NUMERICAM Tape-Controlled Cam Milling Machine, which saves up to 90% in cam production costs — and the new Deep Hole Drilling Machine that eliminates the need for expensive fixtures.

See them all at Booth 452 . . . or write for full information. Machine Tool Division, Brown & Sharpe Manufacturing Company, Providence 1, Rhode Island.



NEW B&S No. 2 Vertical Milling Machine

Brown & Sharpe  **PRECISION CENTER**

Use Reader Service Card, CIRCLE 56



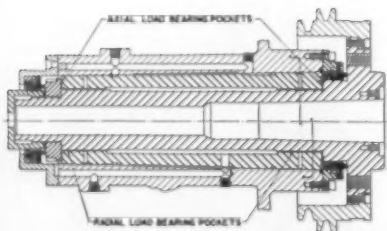
See what's
new
at Booth
452

TO HELP YOU GRIND MORE FOR LESS



New Brown & Sharpe No. 5 Plain Grinding Machine with CEDA/SIZE arrangement.

Brown & Sharpe pioneers new concepts in precision with production grinding to $\pm 0.000010"$ or less



New Supercise Headstock with hydrostatic spindle bearings for B&S Universal Grinding Machines.

At Booth 452, you'll see the Brown & Sharpe Grinding Machines that are eliminating the slow, high cost methods of sizing to ultra-close tolerances. Demonstrations of the new No. 5 Plain Grinding Machine with CEDA/SIZE show how any size that can be measured can be *duplicated*, within millionths, by *plunge grinding* — with average operators, on a production basis.

Partner in precision is the B&S No. 2 Universal Grinding Machine with the new hydrostatic headstock, which produces split-tenth sizing and super finish.

On display also are the new MICROMASTER 824 and 1030 Surface Grinding Machines, which offer all the advantages of the B&S No. 510 and 618 MICROMASTER Surface Grinders, in machines of greater capacity.

Bring your information on grinding progress up to the minute. Visit Booth 452 ... or write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence, R. I.

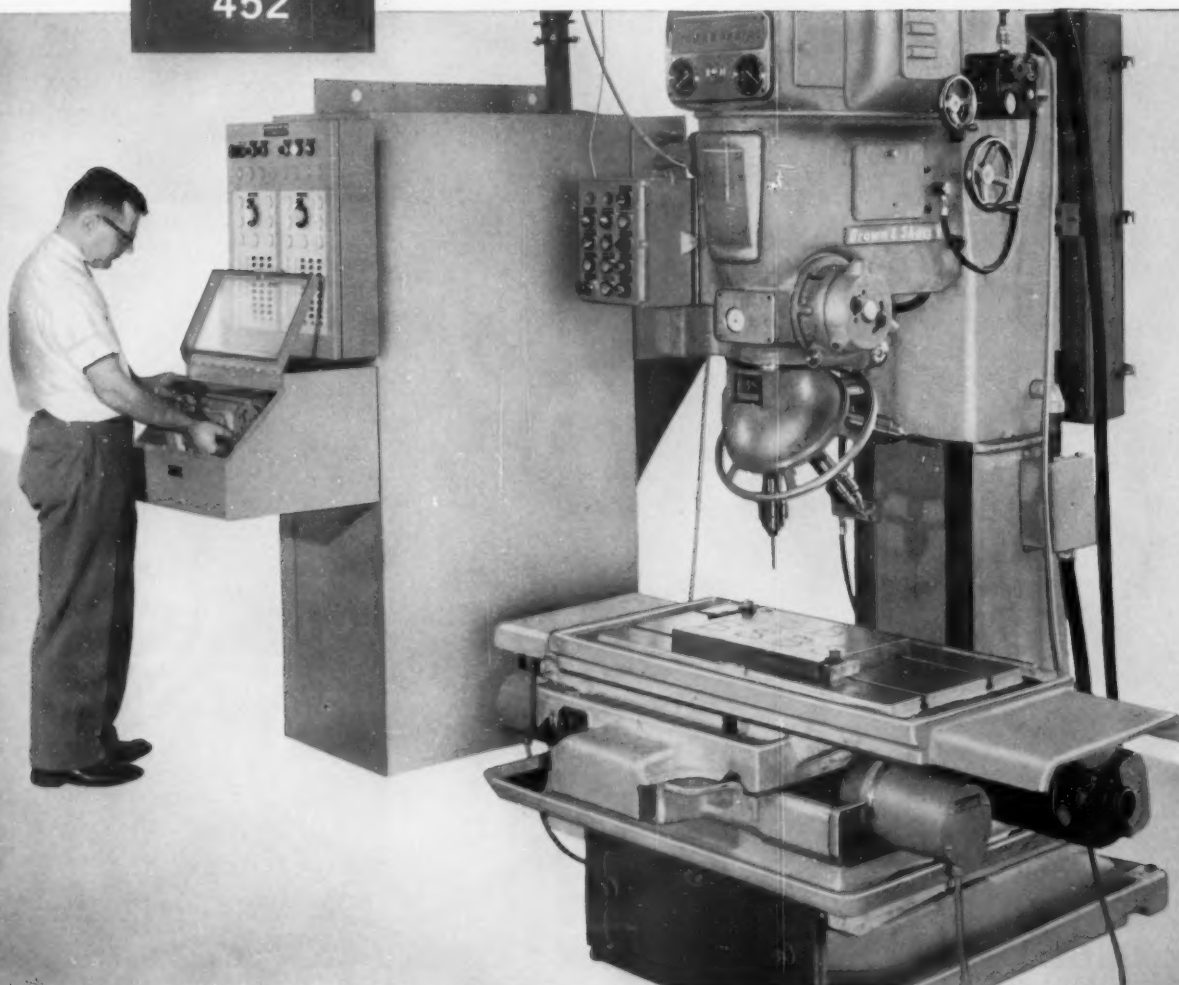
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See what's
new
at Booth
452

TO HELP YOU DRILL AND TAP MORE FOR LESS



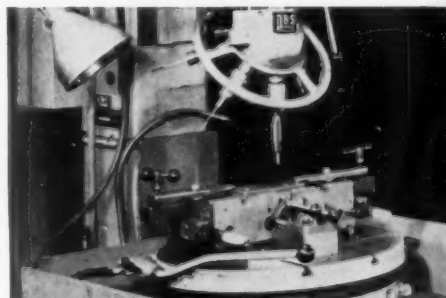
New B&S Model B Turret Drilling Machine with tape-controlled table.

New B&S tape-controlled Turret Drilling permits up to 75 to 1 reduction in tooling costs

Brown & Sharpe Turret Drilling Machines and Work-Positioning Tables regularly score production gains as high as 5 to 1 over conventional gang-drill box-jig methods, with manual or automatic operation. Now, tape-control adds tooling cost savings as high as 75 to 1.

This revolutionary advance in automation of drilling, tapping, reaming, and boring is on view in Booth 452. Completely automatic, fully integrated locating and machining operations are performed by the B&S Model B Turret Drilling Machine and the B&S Work Positioning Table, guided by a tape control.

Plan now to see this dramatic demonstration if you attend the Exposition . . . or write for details: Machine Tool Division, Brown & Sharpe Manufacturing Company, Providence 1, Rhode Island.



Manually operated Model A B&S Turret Drilling Machines and Positioning Tables provide jig-less drilling at low cost.

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MMT-PE

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452

TO HELP YOU GRIND MORE FOR LESS



Up to 300% faster form grinding in carbide, ceramics — Brown & Sharpe MICROMASTER with VISUAL GRIND

VISUAL GRIND, the built-in comparator on the B&S 618 Surface Grinding Machine, permits tool and die makers to meet today's demand for intricate shapes in super-hard materials with spectacular savings in work hours and wheel costs.

Skilled operators can save up to 300% in set-up and grinding time. There is no need to remove work for frequent inspection with separate equipment. Semi-skilled workers, also, quickly learn to "follow the line," and match the clearly visible, true image of the work to the form layout drawn on the screen. Wheel costs are drastically reduced in grinding carbide and ceramics — any contours can be reproduced with a few simple wheels.

An unlimited variety of forms can be produced in punches, dies, and similar work — with through, blind, or template grinding — using standard equipment and simple attachments.

The MICROMASTER® with Visual Grind provides all the extra profit-saving advantages of the new B&S 618 Surface Grinder. It can be readily used for other grinding, of surfaces up to 6" x 14", without disturbing the optical system.

THE VISUAL GRIND® system is manufactured by The Cleveland Grinding Machine Co. and is sold only by Brown & Sharpe. For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

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See what's
new
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TO HELP YOU MAKE PRECISION MEASUREMENTS
EASIER AND FASTER . . .



New B & S "Tri-Mike" measures diameters of 3-flute cutters — reads fast, works easily in one hand

You can measure 3-flute cutters in seconds with this new Brown & Sharpe Tri-Mike — or check the roundness of centerless-ground stock. Tri-Mike's finger hole makes it easier to grip than other tools of this type. Slanting barrel graduations that "can't hide" prevent 25-thousandth errors. Other features: Carbide-faced anvils and spindle; convertible thimble action; thumb-operated, "wrap-around" lock. Range: .093" to 1.000", by thousandths.



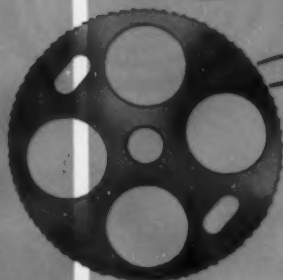
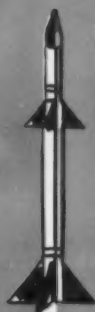
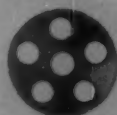
B&S low carbon "Thrift" Stock costs 60% less than oil-hardening precision stock. 265 packaged sizes available identified full 24" length. Ground to 35 micro-inches or better.



B&S Micrometer Inspection Kit helps any shop keep micrometers uniformly accurate, without sending them out. Includes spare mikes, standards, and maintenance materials.

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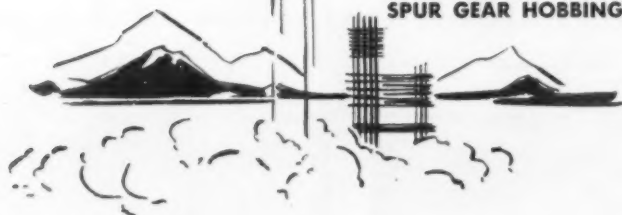
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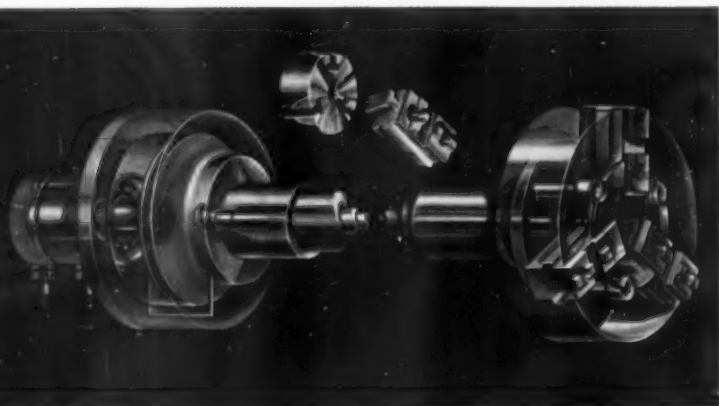
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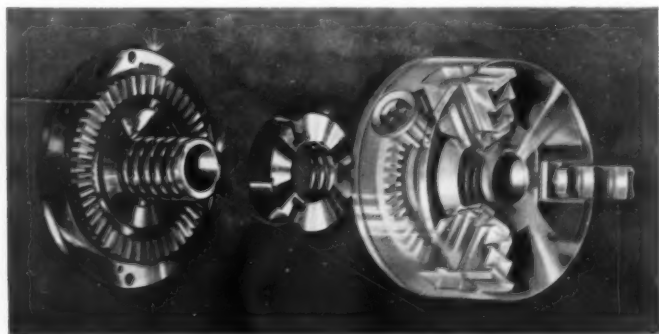
SKINNER PACKAGED POWER CHUCKING ASSEMBLY



Typical major chuck developments that come to you from SKINNER



Packaged power chucking assemblies are available for Atlas, Cintilathe, Hardinge, Logan, Regal, Sheldon, South Bend, and many similar lathes. Assemblies are also available for Brown & Sharpe and similar automatic and hand screw machines to permit chucking of cold drawn parts, small or odd shapes and castings. Packaged assemblies consist of chuck with two or three jaws, threaded drawbar and drawtube, rotating air cylinder, cylinder adaptor and necessary mounting for the individual machine.



Extra-heavy-duty Wedge-Screw chuck combines best features of power and hand chucks. It develops tremendous gripping power, high accuracy and repeatability by a unique principle. When the lug-type pinion is turned manually or by a power wrench, it engages the gear plate causing the screw to move the wedge. The force of the wedge on the jaws holds the work with tremendous power.

This Wedge-Screw chuck has such useful features as:

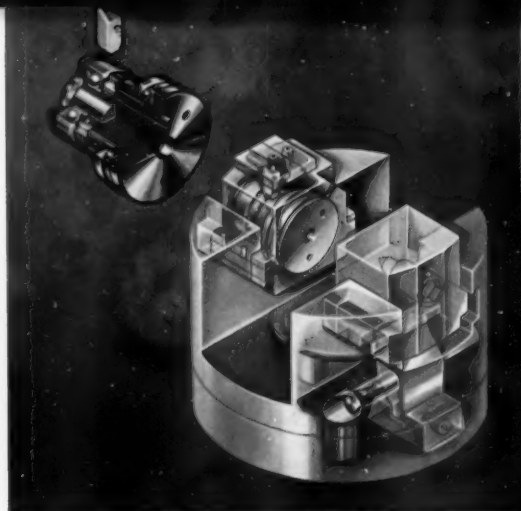
Accuracy—within .001 total indicator reading

Repeatability—within .0005 total indicator reading

Complete Range—no size limitation

Many other features including over-tightening and operator protection, sealed operating mechanism, automatic lubrication, etc.

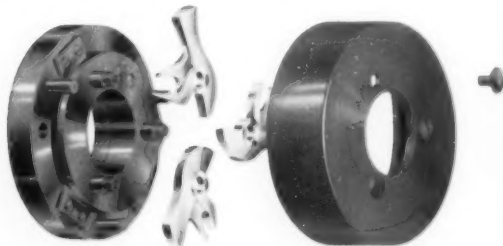
For complete details about packaged power chucking assemblies, indexing chucks, wedge-screw chucks, +6F+ Work Drivers, other chucks and chuck equipment, contact your Skinner Representative or Distributor, or write us at the address below.



Heavy-duty power chuck with jaws that index freely under full pressure. Indexing is simple, easy, and fast. The operator can index manually without touching the work or releasing the pressure. Jaws are indexed by means of a lock screw and slide plate. Note the size and shape of the indexing pin. It fits firmly and positively into the indexing plate so that extreme accuracy of indexing is assured.

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This new Skinner chuck is available in all body diameters from 12" through 36".



+6F+ Work Drivers distributed by Skinner, are the best clamping devices available for driving rough or smooth blanks between centers. Eccentric jaws with floating spring action hold firm, and any increase in cutting tool pressure and or spindle speed automatically increases the holding power of the work driver. The jaws are easily reversed to accommodate changed direction of spindle rotation.

The protective hood covers all mechanism and provides means of manually opening and closing jaws. A slight turn of the hood, with surface cross-hatched for sure grip, opens jaws and holds them open until work is placed between centers—another turn releases jaws to grip work. **+6F+ Work Drivers** are available to hold work ranging in diameter from $\frac{11}{32}$ " to $8\frac{1}{16}$ ".

Maximum eccentricity of any piece is $\frac{3}{16}$ ". Finished adaptor plates or rough castings are available for mounting on all types of machines.

See these Skinner products at the Production Engineering Show Booths 212 & 214.



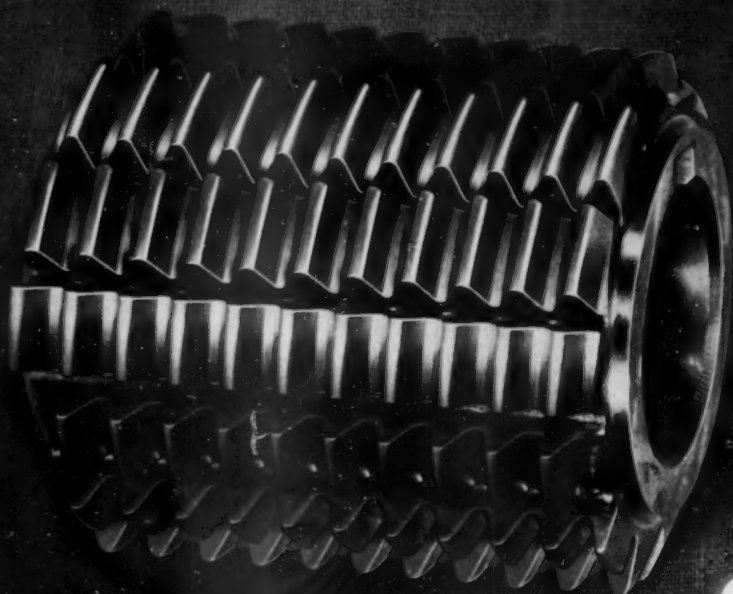
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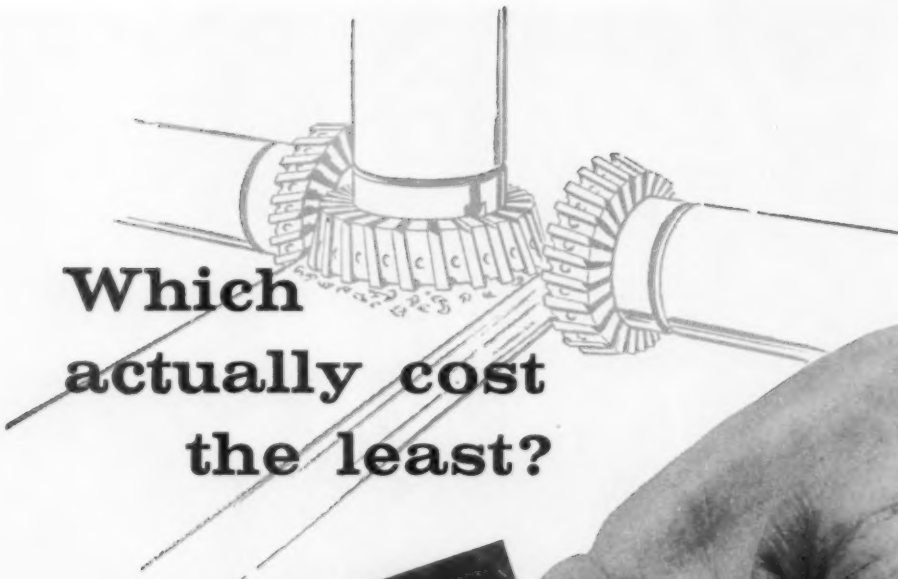
Latrobe regularly produces over 18 grades of Desegatized XL high speed steels, many stocked for prompt delivery from warehouse and mill stocks. For your next tool steel application... call Latrobe! Our sales engineers will be pleased to provide technical assistance to help you select the *right* steel for your application.

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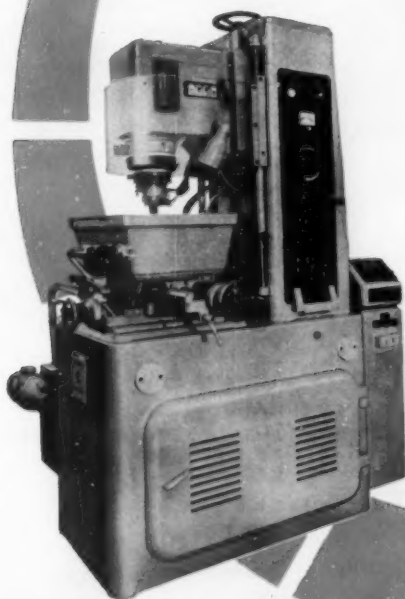
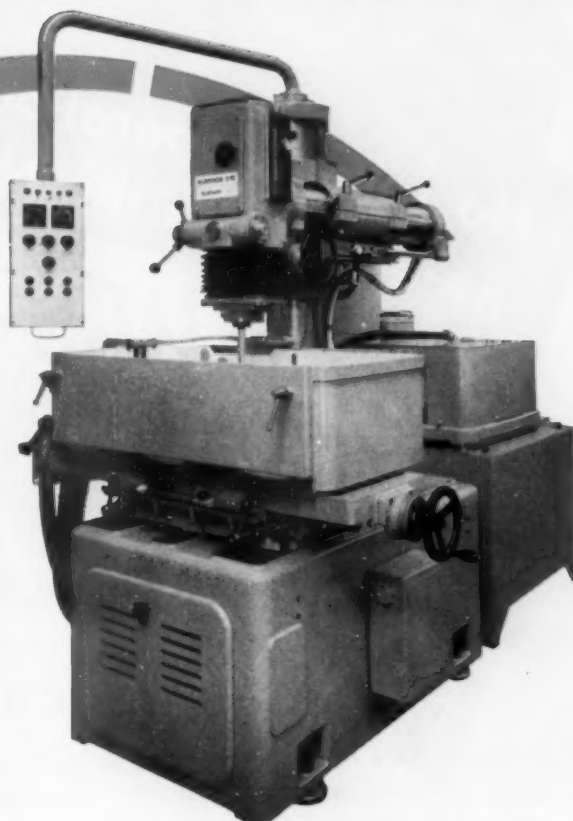
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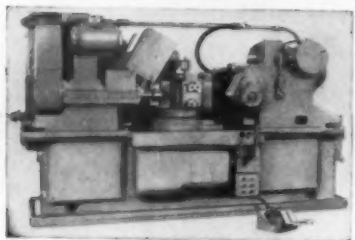
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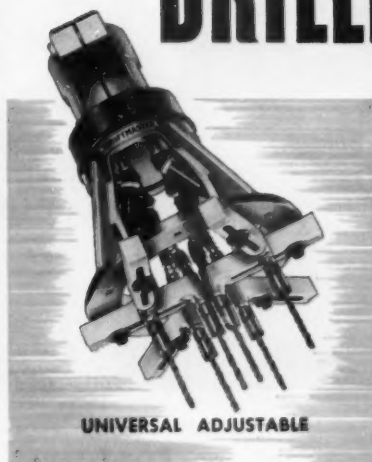
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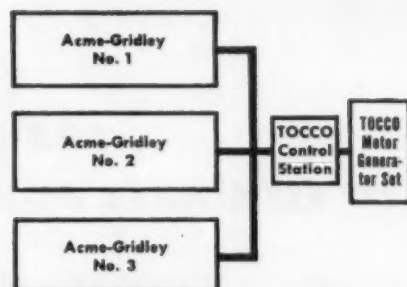


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The machine tool industry has been fundamental in the development of America's industrial might. The industry has played a leading role in bringing us the highest material standard of living of any nation.

You as a tool and manufacturing engineer do the analyzing, planning, requisitioning of these machines and production equipment. You have been responsible for the organization of our production facilities that has made America's material progress so outstanding.

Appropriately, this issue is published under a new name, THE TOOL AND MANUFACTURING ENGINEER and pays tribute to the machine tool industry and its exposition by containing articles on machine tool processes and an exposition-in-print special section. With its new look, the magazine, like the Society, remains steadfast in its purpose. . . . to serve you as tool and manufacturing engineers.

Today, the machine tool industry is being challenged by foreign competition. American machine tool builders are fully aware of that competition and have burned midnight oil in research, development, and design to meet and beat their challengers.

Your responsibility is to see that your company utilizes the latest and most efficient machines, equipment and tools available in order to put maximum value into your company's products at the lowest possible cost. If you are concerned with your job and your future security, you will not miss this major opportunity to learn about the new machines and tools at the exposition.

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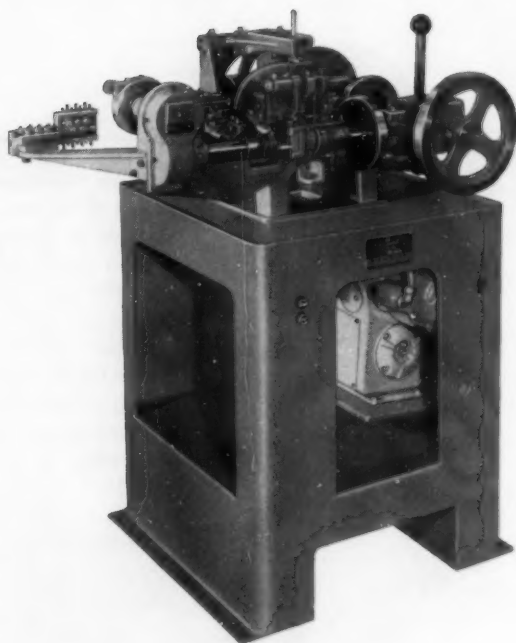
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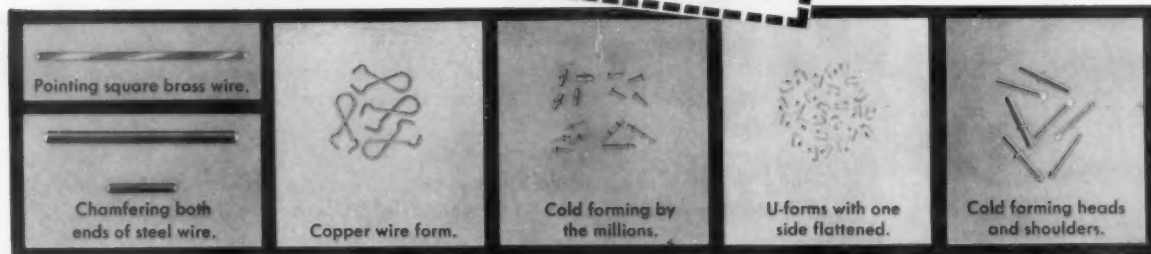
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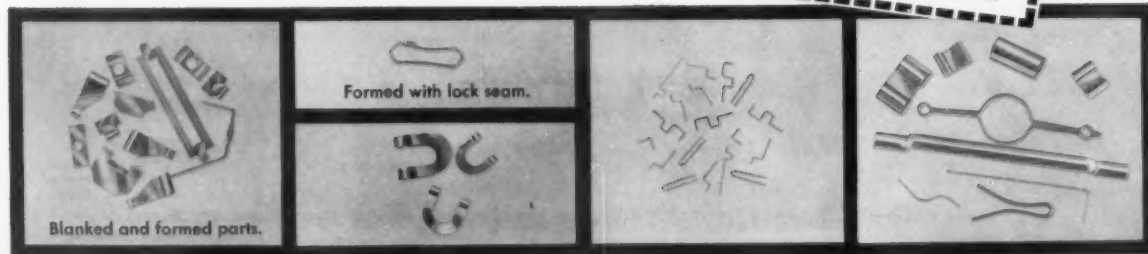
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**... how a machine tool builder
puts modern machines to work**

By T. W. Black
Senior Associate Editor

Machine tool builders, the leading advocates of facilities modernization for American industry, practice what they preach in their own plants. Result: high efficiency.

CAN AN AMERICAN machine tool builder meet and beat foreign competition in the American market? With foreign labor rates averaging less than \$1 per hour, as compared with \$2.30 an hour for skilled labor in this country, some observers feel that there's little hope for the machine tool industry without help in the form of government subsidies or tariff barriers.

One of the people who disagree with this prophecy of economic doom is Walter K. Bailey, president of Warner & Swasey, Cleveland manufacturer of turret

lathes and automatic chucking lathes.

Last year, Warner & Swasey bounced back from the recession that reduced machine tool sales in this country to near-depression levels. Warner & Swasey machine tool sales totaled \$30 million—nearly as much as the total sales of all foreign machine tool builders in this country (\$33 million). And for 1960, the company expects to further increase machine tool sales by 15 percent.

What is the secret of this success?

First, says Bailey, Warner & Swasey has concentrated on designing and building new machines that—because of their higher productivity—make existing machines obsolete. Last year the company introduced a brand-new, single-spindle automatic and shipped 60 of these \$50,000 machines to customers. At the Machine Tool Exposition in Chicago this month, Warner & Swasey will introduce a new small-size turret lathe for precision work, a single-spindle chucking automatic for producing small or miniature parts, an electronic tape-control mechanism that can be applied to any of the company's existing single-spindle automatics, a standard turret lathe equipped with tape control, and a completely new large-size turret lathe, radically different

in appearance and operation from present machines.

All of these machines produce a greater number of pieces per hour than older machines or they can be operated by fewer people. In either case, high returns on the capital investment make the new machines attractive to cost-conscious customers.

Can these machines compete with foreign-built equipment? Yes, says Bailey, because most customers want the productivity that is built into standard American machine tools. When European machines are designed for equal productivity, their price in the United States is close to the price of American machines.

A second factor in Warner & Swasey's rise has

been its ability to keep its own manufacturing costs—and thus the cost of its machines—down. The company's main stock in trade is the productivity of the machines it builds and Warner & Swasey has taken a large dose of its own medicine. Late-model machine tools, many of them fully automatic, have been put to work throughout the plant. And, through preplanning, effective communications and sound manufacturing engineering, these machines give optimum productivity. Result: high efficiency that has enabled the company to keep competitive in a dog-eat-dog market.

Preplanned Operations: In its Cleveland plant, Warner & Swasey makes 17 models of ram and saddle type turret lathes, five models of precision threading and tapping machines and a number of different types of machines for the textile industry. During the course of a working month, some 6000 different part designs are processed in the plant and assembled into some 80 machine tools. The average production run is about 30 parts, which are processed on one or more of the 784 machine tools in the plant.

With this many part designs and large number of machines, coordination is all-important. Opportunities for major—and costly—foul-ups are almost limitless and without preplanning some sort of productive anarchy would result.

Warner & Swasey keeps order in its own house by closely controlling all of the phases of production. Manufacturing preplanning starts at the time a product is designed. A team of engineers from the product design and manufacturing engineering departments meets weekly to go over new designs from the manufacturing point of view. Ob-



Fig. 1. (above) Large planer-miller finishes sides and ends of machine bases. Square design of the casting simplifies metal removal.

Fig. 2. Workpiece is carried under the head of this 75-hp grinder by a rotary table. Down-feed is automatic.





Fig. 3. Operator loading a workpiece for lapping. Each ring is 33 inches in diameter.

jective: to make all machine components as easy to process—or assemble—as possible. From a machinist's point of view, for example, box-shaped parts are best; parts with elaborate curves and hard-to-get-at interiors can be a production man's nightmare. The function of a part is, of course, all-important, but the design-manufacturing team finds, time after time, that product designs can be greatly simplified without affecting function.

When part designs have been finalized, manufacturing engineers take over, deciding how—and on what equipment—the parts will be manufactured. Their planning even covers such details as the motions of the machine operator. Cutting feeds and speeds are developed at this time as well. The results are communicated to the men on the production floor by setup cards that tell the machine operator or assembly man everything he needs to know about running the job efficiently.

Incentives: Even when preplanning is sound, there's ordinarily no guarantee that planned production goals will be achieved. That's up to the men in the shop. Warner & Swasey management finds that an incentive pay plan is the best way to encourage productivity. Workers who put forth more-than-normal effort get higher-than-normal pay.

With incentives, management can count on full utilization of machines and manpower.

Machine Tools: It takes modern machine tools to make modern machine tools and Warner & Swasey has some of the most productive machines in the industry. A recent acquisition is a planer mill used for operations on large castings, Fig. 1. This machine, equipped with four high-horsepower

cutting heads, can remove metal twice as fast as machines previously used for the same operations. Six-foot-square castings, 16 feet long—or several smaller castings—can be accommodated on the massive machine table.

Carbide cutting tools, run at speeds of 250 feet per minute, travel along the workpiece at rates of over two feet per minute, holding tolerances of 0.002 inch. With this high accuracy, the need for

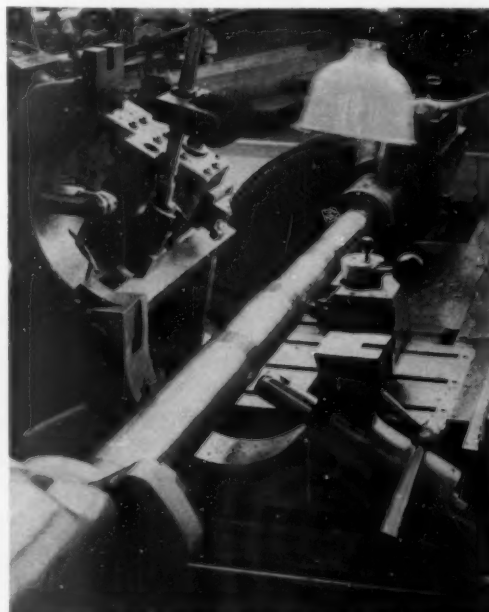


Fig. 4. Setup for single-point threading. This operation is automatic: the cutting tool makes any number of passes required to complete a thread without operator intervention. Carbide tools are used.

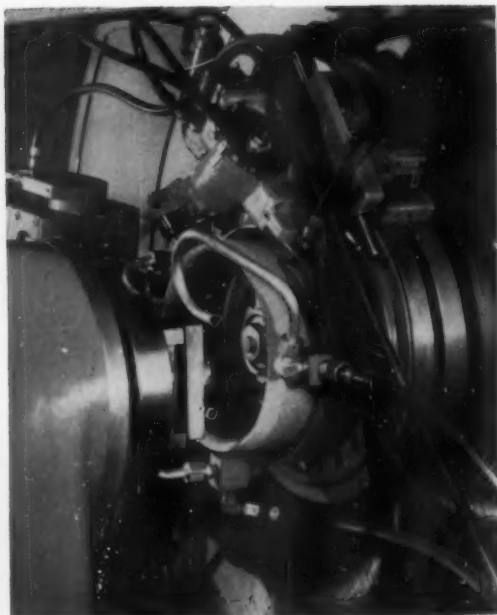


Fig. 5. Curvie coupling grinder. The cup type wheel grinds curved slots in workpiece, which is indexed for grinding of each slot.

subsequent machining operations is eliminated. The simplified design of the castings—square corners, flat surfaces—speeds machining and there is no need for special clamps or other fixturing to hold the workpiece.

High-Production Grinder: Another new machine tool, also selected for its higher production capabilities, is a 75-horsepower grinder, Fig. 2, equipped with a 72-inch rotary table. Parts up to four feet square are held for machining by a magnetic chuck. Once the operator has loaded parts on the chuck and pushed the start button, the operation of the grinder is automatic. Parts are carried under the grinder wheel by the rotary table, and the wheel is fed down to take a deeper cut with each table revolution.

Benefits: Faster production with less manpower and floor space. Better control of accuracy. And, because of the magnetic workholding, complete elimination of costly special fixtures.

Flatness to Millionths: The accuracy of a machine tool depends on the precision with which its components are made. To meet the needs of customers who do precision work (and, in this Space Age, that's just about everybody), Warner & Swasey is machining components to closer tolerances than ever before. The company has installed "super-accurate" machine tools to make components for its own machines. The surfaces of castings, for ex-



Fig. 6. Simple universal fixture guides workpiece into position for chamfering on an abrasive-belt grinder. Uniform chamfers result.

ample, are lapped to within a few millionths of an inch of perfect flatness on a new machine, Fig. 3.

Two important benefits are obtained from lapping. First, the lapped surface, being extremely flat, is an ideal reference surface for subsequent machining operations. With a bottom surface of known flatness and straightness to measure from, top surfaces can easily be made parallel, and drilled or bored holes can all be made perfectly square with the reference surface.

An added advantage: Many machine tool surfaces are bolted together. Gaskets are used to obtain a good seal. Sooner or later, these gaskets deteriorate in service, since they are attacked by oil and other fluids. By lapping both mating surfaces, a good seal is obtained without gaskets, saving the initial cost of gaskets and eliminating customer difficulties caused by gasket failure.

Automatic Threading: Thread accuracy is of paramount importance in all of the spindles used in machine tools. A new automatic threading machine, Fig. 4, is giving excellent results. This machine uses a single-point carbide tool that cuts precision threads in a series of passes, each pass cutting a little deeper into the work.

The pitch of thread to be cut is controlled by a series of gears. Once the operator has made the appropriate gear settings, he presses the start button and the cutting tool engages the work. At the end of each pass along the full length of the thread, the

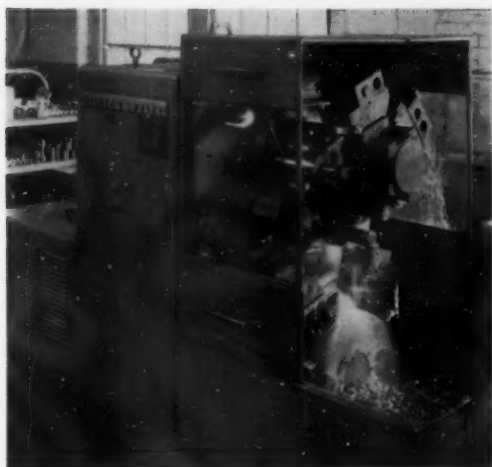


Fig. 7. Automatic chucking machine used to produce gear blanks. One operator controls several machines.

tool retracts automatically, returns to the starting point and goes through the cycle again. Threads are cut at 300-500 feet per minute.

Benefits: Greater accuracy is possible than with conventional engine-lathe methods previously used. Operation is faster than hobbing or thread grinding—two other alternative methods. Because of the automatic operation, the machine operator can be assigned other work during the machining cycle.

Curvic Coupling Grinder: The machine tools discussed so far are all versatile types—they are capable of handling a wide range of part designs and sizes. For performing operations on some parts, however, Warner & Swasey employs highly specialized machine tools. One of these, a curvic coupling grinder, *Fig. 5*, is used to grind curved slots and teeth in the locking devices for machine turrets.

This type of locking device gives more positive action than the lock bolt arrangement formerly used and minimizes sticking—always a problem with lock bolts. Wear is reduced also.

It would be virtually impossible to machine the required curved slots and teeth on general-purpose machine tools. The curvic coupling grinder solves this machining problem and performs the grinding operation automatically to boot.

The wheel is cup-shaped. The workpiece, a disk of hard steel, is fed into the end of the wheel to generate the required contour. When one slot is ground to the necessary depth, the workpiece is indexed for grinding the next slot. All grinding is from the solid.

Use of this special machine tool has enabled Warner & Swasey to incorporate the new locking device in some of its newer machines—with significant improvement in machine accuracy, productivity and reliability. An added benefit is the automatic high-speed operation, which has made a major product improvement possible at low cost.

Abrasive Belt Finishing: At the opposite end of the production spectrum from the curvic coupling grinder are the belt-finishing machines used in the plant, *Fig. 6*. These, too, have been installed to improve quality—in this case to produce better chamfers on cast-iron parts.

Chamfering operations are required on many of the small castings used as machine tool components. Traditionally, these chamfers have been made by operators using hand files. Productivity of manual operations is low and there is always a possibility of spoiling a part. Also, it is almost impossible for an operator to make uniform chamfers by hand filing.

Abrasive-belt machines, equipped with simple universal fixtures to guide workpieces against the abrasive belt, have increased the output of chamfer-

Fig. 8. Bandsaw for cutting off slugs from bar stock. Once the length of bar stock is in position for machining, cutting off is automatic.

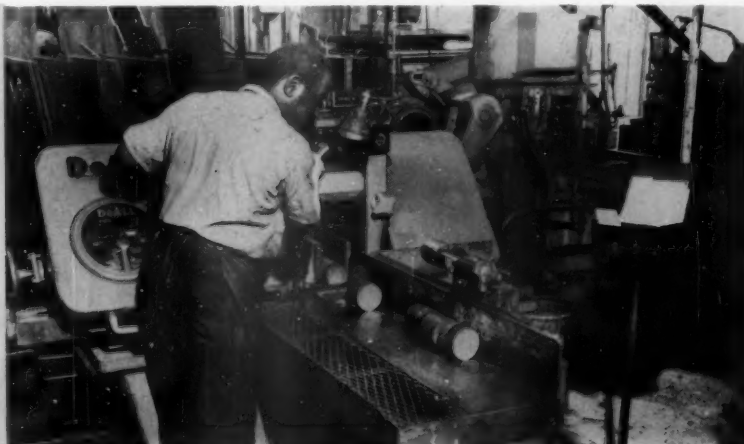


Fig. 9. Center holes are drilled in gear blanks in this dual-fixture drill press. Operator can load one blank while the other is machined.

Fig. 10. (below) With a workpiece clamped for machining, operator inserts punched tape that will control all subsequent operations.



ing operations and made a significant improvement in product quality as well. Surface finishes in the 15-20-microinch range are obtained.

"Slugging": Warner & Swasey is in the fortunate position of being able to use turret lathes and automatic chucking machines of its own manufacture in its plant, Fig. 7. As a major user of its own machines, the company is able to obtain valuable feedback on problems of machine operation on a day-to-day basis. In a sense, this makes the production floor a testing laboratory.

Efforts to improve the productivity of these machines by preplanning have met with great success. Since the production runs are short, setup time can consume a large percentage of total machine time. To keep setup time at a minimum, complete sets of sharpened tools for each job are placed in wooden boxes and are brought to the machine well in advance of the time for setting up the job. When the machine operator finishes one lot of parts, he

has everything needed to set up the machine for the next lot. This preplanning enables the company to keep its turret lathes actually in production about 85 percent of the time.

A shop practice known as "slugging" has enabled Warner & Swasey to utilize its extremely productive automatic chucking machines for operations normally performed on large bar turret lathes. In bar turret lathe work, parts are completely machined from a bar of stock that passes through the machine, then cut off the end of the bar by a parting tool. Large machines are required to handle the heavy bars, which are difficult to start, stop or reverse during machining and hard to handle on the production floor.

Reasoning that the cutting-off operation could be more economically performed in a separate operation, Warner & Swasey engineers developed a system for cutting off slugs or metal blanks in a circular saw or band saw, Fig. 8. The resulting slugs are brought to the automatic chucking machine, which is smaller and faster than an equivalent bar turret lathe.

Carrying the same philosophy a step further, Warner & Swasey also machines center holes in the blanks in a separate drill press operation, Fig. 9. While these holes can be drilled in the automatic chucking machine, it is more economical to drill them separately. Since the bandsawing and circular sawing operations are automatic, the saw operator has ample free time to drill the blanks.

Savings: Depending on the size of the production run, cost savings in the production of gear blanks have been up to 50 percent as compared to the cost of producing the same parts on bar turret lathes. Despite the added capital investment involved in cutoff machines and drill presses, the

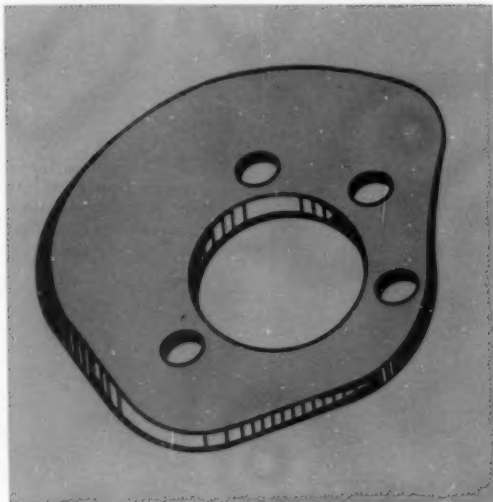


Fig. 11. Master cam, produced by numerical control.

greater productivity of the automatic chucking machine has made slugging extremely worthwhile. Another benefit has been in reduced material handling time in the shop—the metal slugs are much easier to handle than lengths of bar stock and it is not necessary to return bar ends to storage after the required number of parts are machined.

Numerical Control: Warner & Swasey makes its own numerical control system, the Probomat. This is a positioning type control, designed mainly for accurate location of holes. Applied to many drilling and boring operations in the plant, numerical control has demonstrated its ability to more than double machine productivity and enhance accuracy as well, Fig. 10.

One of the more interesting applications of nu-

merical control in the plant is for the machining of master cams, Fig. 11. The same positioning system that is used for boring is used to produce curved cam surfaces. In most of industry, the much more costly contouring control systems are used for this purpose. However, the ability of the control system—and the precision boring machine it is used with—to move the tool in small increments makes contouring operations possible.

Contouring one master cam by jig boring methods used to take 20 hours of machine time. Contouring the same cam on a precision drilling machine under numerical control takes only six hours of machine time. Taking into account the cost of developing a machining program and punching a control tape, dollar savings are substantial: a cost of \$130 for a cam produced by conventional methods versus \$84 for a cam produced by numerical control.

Originally, it was intended to use numerical control only for production of master cams. These cams would, in turn, be used in a tracer-controlled cam miller to machine production quantities of cams. However, the company now makes production quantities of cams on the numerically controlled machine. Lots of 25 cams can be produced by numerical control for less than the cost of tooling up for tracer milling.

Use of numerical control is not restricted to metalcutting operations at Warner & Swasey. By substituting an electronic gage for a cutting tool, a precision boring machine has been converted into an automatic inspection machine. Following a tape-controlled program, the gage checks hole size and location and other critical dimensions.

An advantage of this automatic inspection technique is that a workpiece can be checked while it is still in position for machining. Hence any rework



Fig. 12. Tape-controlled inspection fixture (left) checks the performance of an electrical control panel (right). Any necessary repairs are made by the inspector.

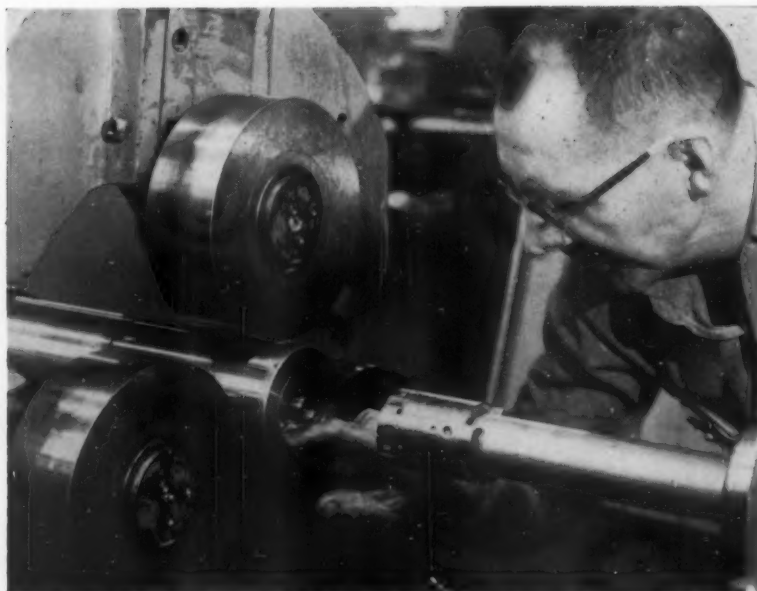


Fig. 13. Tooling for trepanning operation. The core left by trepanning appears above the operator's forefinger.

can be accomplished immediately without the need for a second setup. Another advantage is that there is generally no need for elaborate—and expensive—checking fixtures. All of these advantages add up to lower costs.

The human tendency of the machine to overlook its own mistakes is overcome by occasionally checking test parts of known accuracy.

Electrical Panel Check: Tape controls are also used for final testing of electrical control panels. These controls are complex, containing hundreds of yards of wiring and dozens of switches, relays and related devices.

In tape-controlled inspection, *Fig. 12*, the control panel is put through its paces according to a definite program. Any action or combination of actions can be simulated. If there is any malfunction of the panel during testing, the test is automatically stopped and the operator, using a circuit diagram, is able to quickly locate and correct the trouble.

Testing time is 45 minutes, including setup, compared to six hours for manual checking.

Trepanning: Warner & Swasey engineers have not hesitated to borrow ideas from other industries to get greater productivity. Trepanning operations are a case in point. Trepanning has been used by makers of large forgings for many years. In this type of holmaking, holes are produced by cutting out a narrow ring of material in the workpiece, leaving a center core, *Fig. 13*. The advantages are faster cutting, better hole concentricity and finish.

To get the benefits of trepanning, the company had to design and build its own 100-horsepower

trepanning machine—there weren't any suitable machines on the market.

Savings have been substantial. Some 143 minutes were required to spade drill a 4¾-inch-diameter hole in a four-foot-long part. An additional 24 minutes were required for reaming. To produce the same hole by trepanning, only 21 minutes are required and the need for reaming is eliminated.

Summing Up: Warner & Swasey's manufacturing philosophy can be summed up as follows:

1. Preplan all operations so that the most efficient methods will be established.
2. Make sure that the plan for each operation is communicated to everyone concerned—including the man on the production floor.
3. Provide incentives to make sure that planned productivity is achieved.
4. Use modern machine tools—and don't hesitate to apply automation when it can do you some good.
5. Don't forget that inspection can be an important area for cost savings.
6. Keep looking for opportunities for methods improvements—the way you're doing things now may not be perfect.
7. Keep abreast of what people in your industry—and other industries—are doing, so that you can keep ahead of the crowd.

These are some of the rules for production progress.

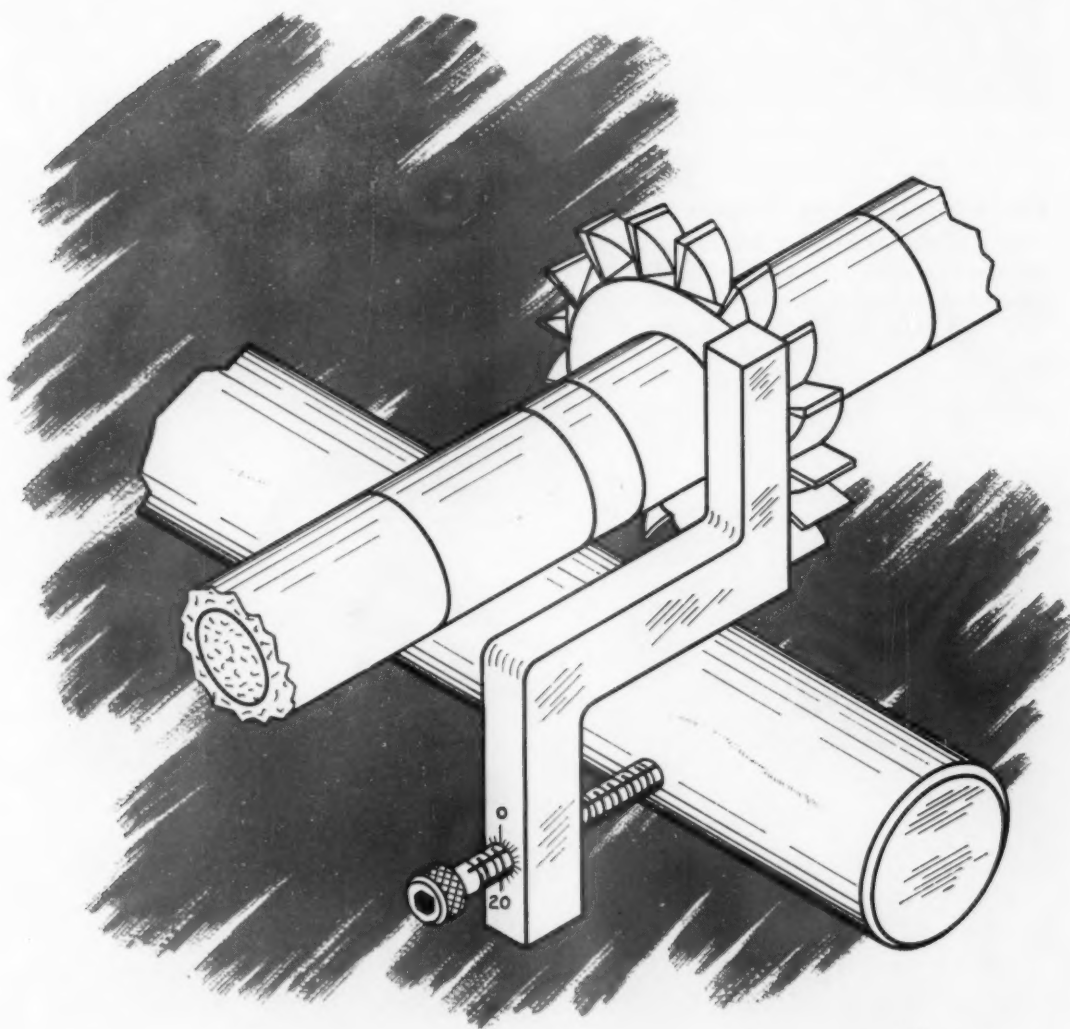
With a new product research center at Solon, Ohio, now going full blast, new machine tools will be introduced at a rapid rate. Warner & Swasey manufacturing people will have their hands full getting these machines into production on schedule. But, by applying their present philosophy of manufacturing, company engineers feel that they can take all new developments in stride.

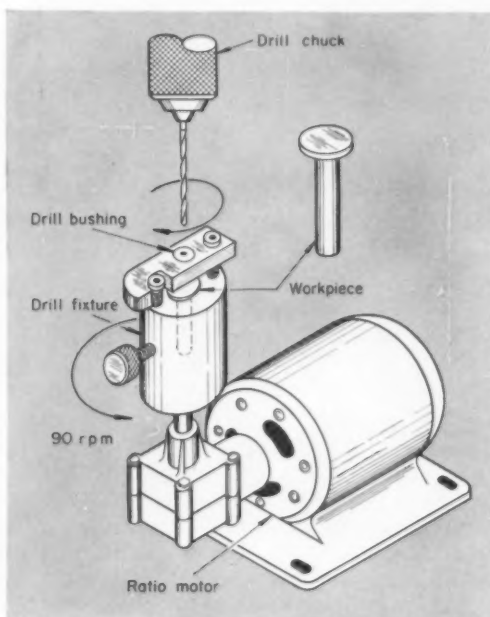
Finder for Fast Centering

Cutters can be quickly and accurately centered over shafts with the center finder illustrated. This tool consists of a Z-shaped piece of flat stock into which a $\frac{1}{4}$ -20 hole is tapped. A notched socket-head screw threaded into the hole provides an accurate micrometric adjustment. Readings are taken by noting the notch position relative to scribed graduation at the hole.

After cutters are rough-centered visually, readings are taken from each side of the shaft. Differences in the readings indicate amount and direction of table correction necessary.

Ernest Jones Bronx, N. Y.





Deep Hole Drilling Fixture*

When drilling deep holes less than $\frac{1}{8}$ -inch diam in small, thin workpieces, preventing runout and maintaining concentricity are sometimes problems. The gadget illustrated reduces these difficulties by rotating the part in a direction opposite to the rotation of the drill chuck. The rotation is accomplished with a ratio motor on which a drill fixture is mounted.

The motor with the fixture attached is located under the drilling spindle with a dial indicator. The part is inserted in the drill fixture cavity and clamped with a thumbscrew. A bushing leaf on the fixture is swung into position and locked.

The drill is run at the highest speed feasible for the workpiece material. The motor is operated at approximately 90 rpm at the vertical output shaft. The drill is hand advanced into the work and momentarily retracted every $\frac{1}{8}$ inch drilled to relieve chip pressure in the flutes.

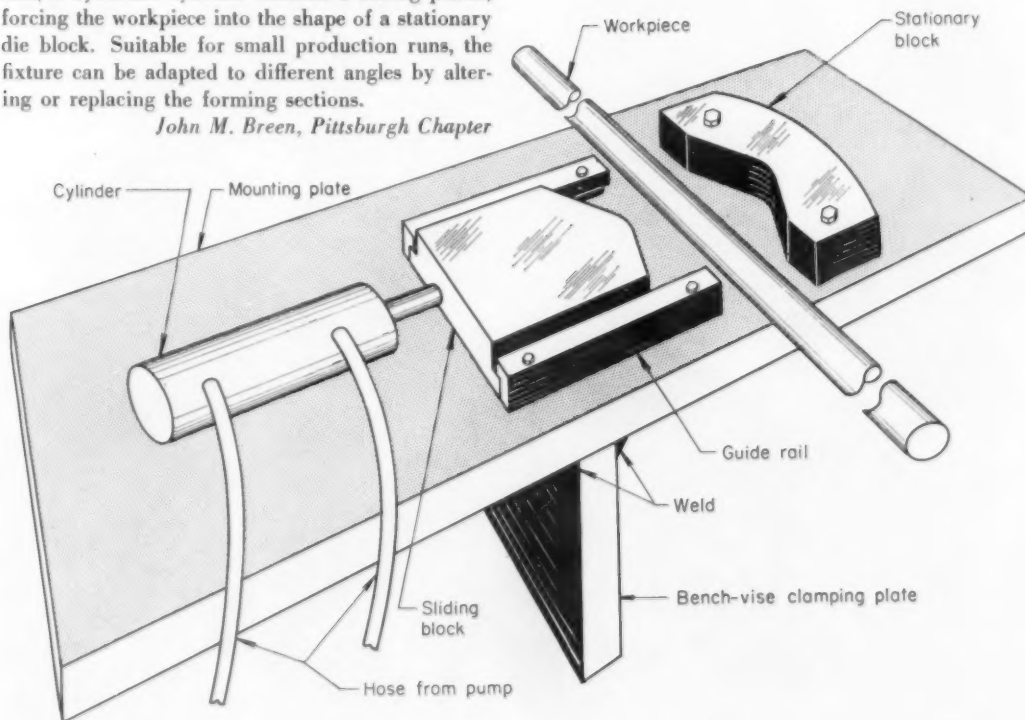
*William S. Mazar
Binghamton Chapter*

Low-Cost Bending Fixture

This bench fixture utilizes hydraulic units to effect simple bends. To perform the bending operation, a hydraulic cylinder actuates a sliding punch, forcing the workpiece into the shape of a stationary die block. Suitable for small production runs, the fixture can be adapted to different angles by altering or replacing the forming sections.

John M. Breen, Pittsburgh Chapter

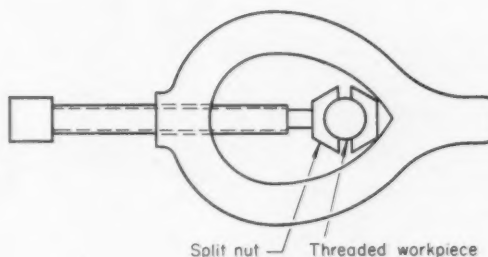
**Gadget Contest Entry*



Driving Dog

When turning a workpiece with threaded ends, the method illustrated can be employed to avoid damage to the threads. A standard nut of corresponding thread size is cut longitudinally and placed on the threads of the workpiece. The dog is tightened with the screw against one flat of the nut.

*Federico Strasser
Santiago de Chile*



Small Parts Feeder*

Various conditions such as proximity of machine components or high temperatures may restrict access to small holes in which parts must be fed. The device illustrated can be used for such feeding operations either for automatic or semiautomatic operation. The mechanism has a small funnel which opens to release a part each time the assembly machine indexes.

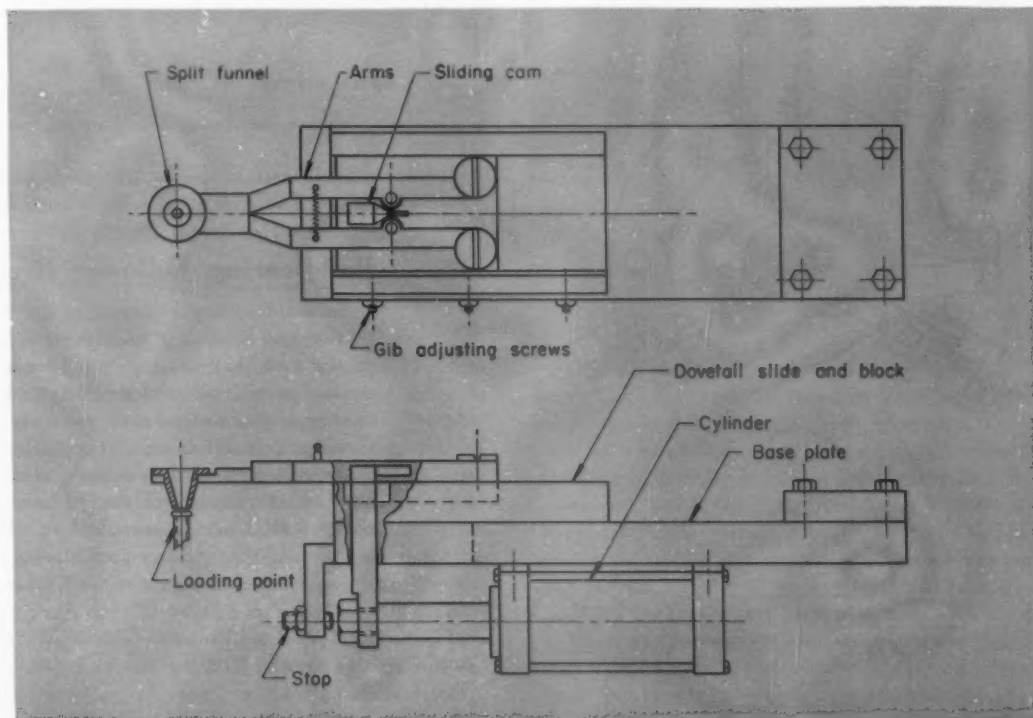
The machine turret indexes to the rest position and a machine timing cam actuates a cylinder control valve to advance the cylinder to a stop, closing funnel arms through a sliding cam. The stop is adjusted to line the funnel up with the hole in which

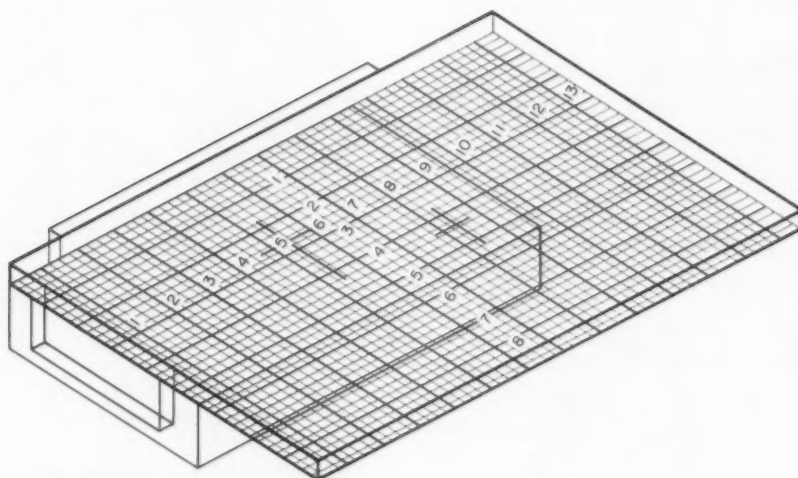
the part is to be inserted. The part is then loaded into the split funnel. Just before the next machine index, a timing cam reverses the control valve retracting the air cylinder. At this time, the sliding cam opens the split funnel and drops the part. The arms and slide block are held in position by friction of a gib on the dovetail until opened by the sliding cam. The sliding block and arms then retract as a unit, allowing the assembly machine to index without interference.

A. G. Grant

London-St. Thomas District Chapter

*Gadgets Contest Entry



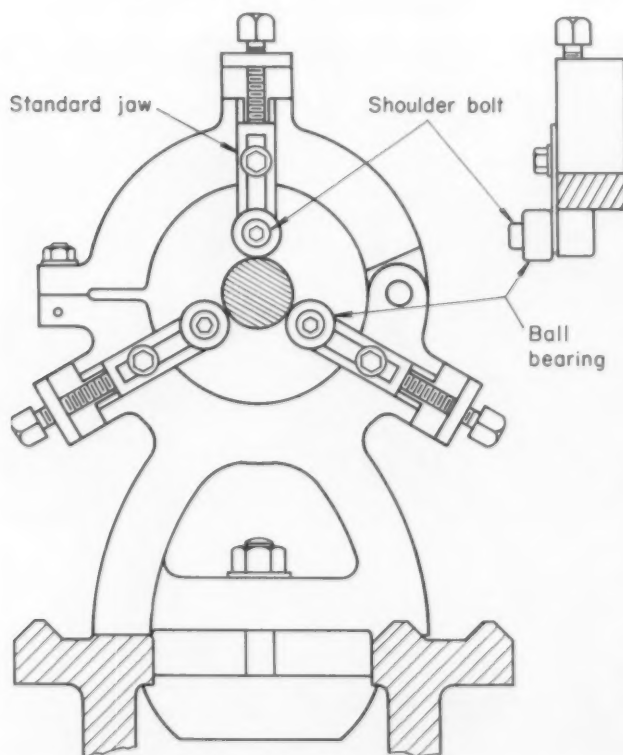


Plastics Grid Gage

When die blocks are laid out using a height gage, the diemaker, concentrating on accurately setting the gage, may make an error of an inch or $\frac{1}{10}$ inch. The plastics gage shown affords a means to make a quick check for proper position and relation of holes after they have been laid out and before drilling. A grid pattern of lines is scribed $\frac{1}{4}$

inch apart on a sheet of clear plastics material. The full inch lines are scribed deeper than the rest. The lines are filled with crayon or ink. The grid is placed over the die block and the approximate distances noted.

*Clint McLaughlin
Rockaway, N.Y.*



Ball-Bearing Follower Rest

To avoid damaged workpieces due to friction and binding of steady-rest jaws on the work, ball bearings can be used on the jaws as illustrated. A suitable bearing is mounted on each jaw with a shoulder bolt as shown. This method permits high machining speeds, eliminates chatter marks and can be safely used on all kinds of materials.

*Klaus L. Schlesinger
Los Angeles Chapter*



MORE CHIPS NO CHATTER

... lathes have new look

By John W. Greve, Editor

Automatic controls, higher horsepower and greater rigidity have doubled and tripled lathe productivity during the past decade.

PRODUCTIVITY is the only true measure of industrial progress. During the past decade machine tools have been improved tremendously. The productivity of lathes, for example, has been doubled and tripled. Ten years ago a manufacturing engineer who was looking for a new and more productive lathe usually found that the lathes on the market were not very different in design—or in productive capacity—from models already in the shop. Today the reverse is true. Several decades of design improvement have been compressed into a few years and lathes that were star performers ten years ago are being eclipsed by their modern, more productive, counterparts.

This improvement has been the result of something more than mere increases in horsepower and capacity. Lathe designers have sharpened their wits as well as their pencils and have abandoned traditional concepts of how a lathe ought to look. Gone, too, are some of the traditional troubles of lathe operators. Closer attention to machine balance and rigidity has largely eliminated vibration and chatter problems. Consequently surface finishes are better—in fact finishes produced by some of the new lathes are so good that subsequent grinding operations are not necessary. At the same time, feeds and speeds have been upped so that the production potential of carbide and ceramic cutting

Fig. 1. Turret lathe combines tape control and memory system for sequencing automatic turning operations.

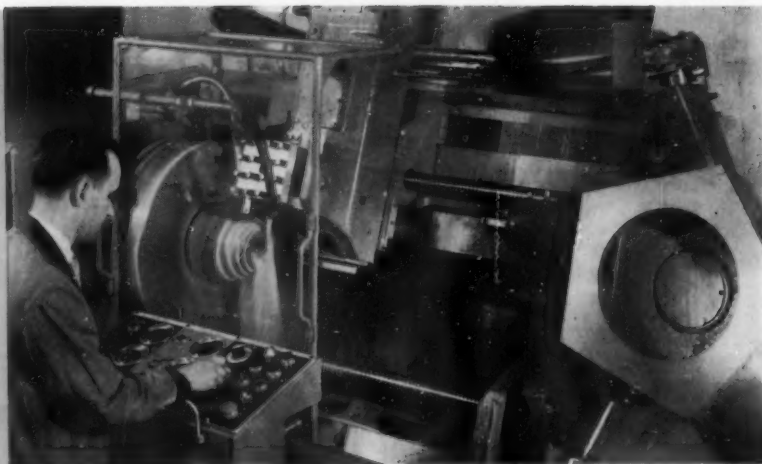
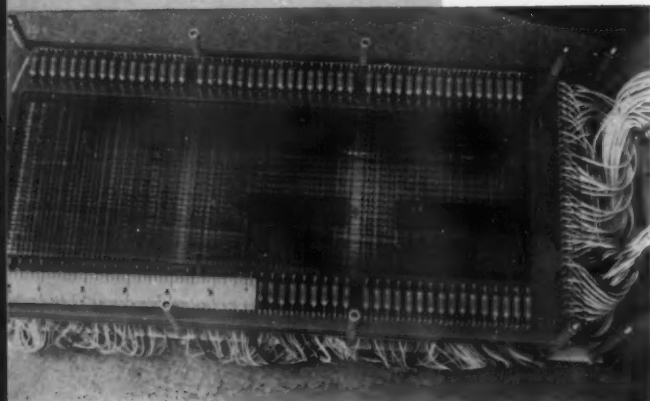


Fig. 2. (below) Heart of Warner & Swasey turret lathe is this memory core containing ferrite memory cells.



tools can be fully utilized. And, with improvements in the design of lathes, automation has been put to work, making already-efficient lathes even more productive. Result: older lathes are obsolete.

Controls: Control features have been developed to the point where almost any degree of automation is available. Advancements have been particularly outstanding in controls for programming and cycling, often making piece costs for production lots of 25 or 30 as low as those for longer runs. With economical short-run production systems, there is no need for large—and costly—inventories of parts.

A few years ago, automatic controls were not considered practical on two counts. They were bulky and required considerable space. Also, they needed much maintenance, resulting in costly downtime. Miniaturization of controls and development of solid-state relays and printed circuits have done much to extend practical applications in machine tools. In addition, the reduction of heat-producing elements in electrical controls has aided in miniaturization through further reduction in control

cabinet sizes and in the freedom in their location. Dust-tight sealing of these smaller enclosures has further enhanced application and dependability.

Although control developments of these types have not been confined to lathe applications, much of the early experimentation involved lathes. For that reason automatic control features have become available in lathes at an earlier date than for other machine tools.

Many intangible gains are realized through each extension of automatic controls to programming and sequencing of lathe operations. In addition to obvious cost savings through increased productivity, the variables introduced by an operator are reduced with each extension of automation. This of course continues until the costs of equipment exceed the benefits and savings possible. With each refinement in control, however, additional savings become possible through more automatic operations.

Outstanding with respect to utilizing the latest developments in controls is the lathe shown in Fig. 1. It is noteworthy for many additional reasons, chief among which is the fact that it was designed from the floor up as a completely new machine. Desiring to build a lathe that could be programmed by sequence control and numerical-control tape, Warner & Swasey engineers built this prototype without being inhibited by conventional practices. As a result, in addition to incorporating the latest concepts in control it has many other advanced features. It has no conventional bed. Instead, the ways are rotated toward the back, making the back slide almost vertical. A cantilevered turret is also mounted on these ways.

This feature allows the chips to fall clear and an operator to work close to the tooling. A control console slides on rollers along the machine to a

convenient place or out of the way according to the operator's wishes. There are no conventional dials or micrometer feeds on the machine. Instead, the console has buttons and switches as well as joystick controls for cross slide and turret motions.

The operator has control of the machine at will. At any time he wishes, he may control the machine manually for an operation or for a machine program correction. In setting up, the operator performs the desired sequences, after which the machine can repeat them automatically. The sequence control is based upon an electronic memory system to store and recall operational commands of any machining setup.

Shown in *Fig. 2* is the memory core used for the controls in this lathe. This element has 9216 ferrite doughnuts for storing information. The data are stored in a coordinate system with on-off signals by energizing or magnetizing these cores. The command may be erased by reversal of current to de-energize the cores. With this system, the machine will handle almost 100 separate commands for functions such as change speed, start rapid traverse, etc. Corrections in the memory system in a horizontal machine direction may be made to 0.0005 inch. In a cross direction, corrections of 0.00025 inch can be made.

Metal is now being cut economically with accuracy and good finish. The proportion of machining time to cycle time, setup time and other non-machining functions is relatively low. Therefore the tool and machine handling time has become important as an area for cost reduction and for over-all efficiency. In these areas, efforts are being concentrated in cost reduction programs through increasing the speed of:

1. Cycling
2. Loading
3. Tooling.

Many of the experiences and lessons learned in high-volume production are being applied to low-volume production, with many automatic features available in standard machines. Multiple tooling on slides and on turrets and automatic tool changing have been the subject of much study and analysis.

Tooling for a Gisholt prototype ram type lathe is shown in *Fig. 3*. This lathe has been redesigned to facilitate setup and reduce cycle time. In the operation shown, the floor-to-floor time for machining a bronze valve body is 50 seconds. The lathe is equipped with an automatic hydraulic drive to the turret ram and special cross slide. The drive is arranged for preselecting the automatic operation of deep hole drilling, spindle speeds, reverse feed and start-stop-reverse of spindle. Refinements in the design provide for a 60 percent saving in setup time over that previously obtainable.

Invariably new lathe designs involve the use of more power operations. Not only the machining cycle is becoming more automatic but also other additional functions are included in automatic operations. Reduction of physical effort in operation is evident in all designs. Where operator supervision or control is necessary, the effort of positioning is minimized by convenient location of the control and by servo operation, giving power assistance to the operator.

In special-purpose machines the opportunity to include special features such as loading and unloading becomes promising and economical. Such a machine is shown in *Fig. 4*. A Bardons and Oliver cutoff lathe, it is adapted to chamfer and cut off hydraulic cylinder tubing and to chamfer, groove, form and cut off the cylinder piston rods. Starting with 20-ft lengths of stock on the loading table, all operations are automatic including unloading the cut lengths.

Basically, three types of control are employed for the machine cycle. They are:

1. Template-follower systems
2. Tape control systems
3. Electromechanical systems.

Each has its advantages and limitations which have led to the adoption of combinations for controlling many machines. For instance, template followers are applied to control the machining part of a cycle only. Sequencing is incorporated by using some of the electromechanical methods available such as limit switches, drum controls, cams, etc.

Adding versatility to tracer controls, Jones & Lamson Co. are employing a new slide on their tracer controlled lathe. It is called a 180 degree

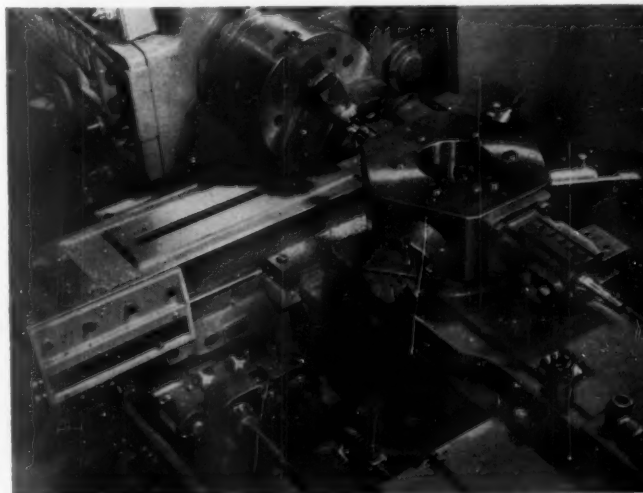


Fig. 3. Automatic ram type turret lathe setup to machine bronze valve bodies. Floor-to-floor time is 50 seconds in this Gisholt lathe.

Fig. 4. (right) Automatic cutoff lathe designed by Bardons and Oliver. All operations, loading and unloading, are automatic.

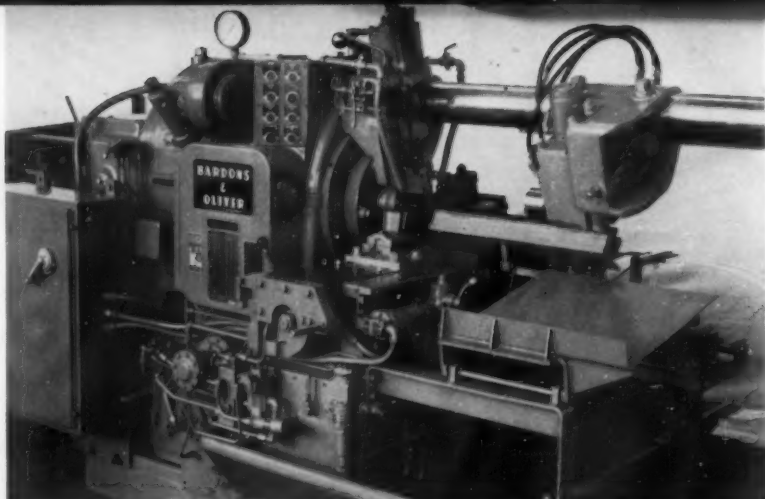
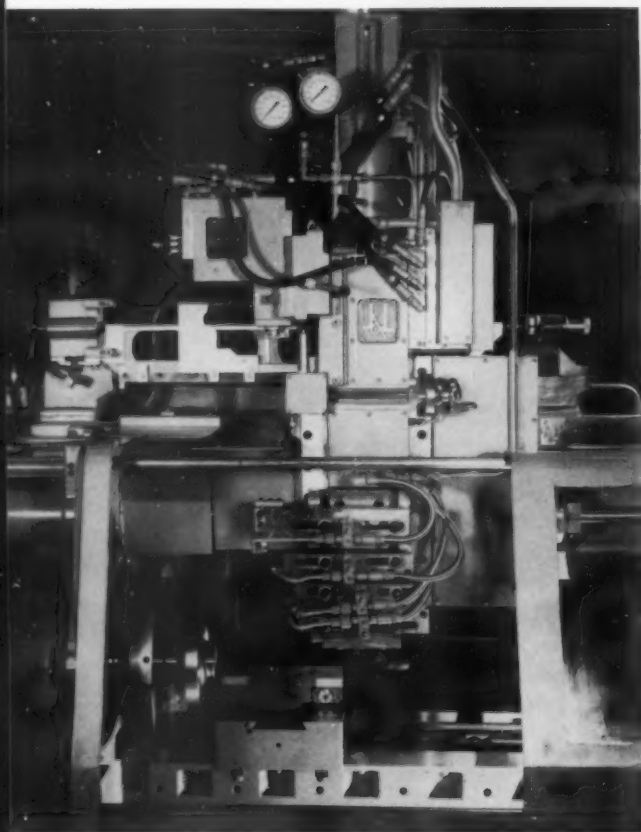


Fig. 5. (below) Tooling arrangement on J & L tracer lathe for machining gear blanks. Multiple tooling provides for complicated shapes. Blanks are machined at rate of 25 per hour.



two-dimension overhead tracing slide. Used with multiple tooling, it can trace operations through any one of eight different motion sequences. This slide is shown in Fig. 5.

Multiple tooling for the various facing, forming and turning slides on the lathe in conjunction with automatically controlled tracing cuts provides tooling opportunities for machining complicated parts. The eight different slide motions provide for tracer control of turning and boring in both directions

as well as facing toward and away from the spindle axis. Other features of the lathe worthy of note include the location of the spindle and slide which overhang the bed. This provides for easy chip removal or for the installation of a chip conveyor. The chips fall free of the bed.

Tape controls are capable of directing all machine functions. Frequently, however, sequencing operations other than machining are controlled by limit switches. Tape control for functions of coolant, spindle speed, tool change, etc. is relatively time consuming. For that reason, trends are toward combination systems. In fact, the combination of all three systems has proved practical. The only limitation appears to be the justification of all systems which, in effect, overlap in ability to perform.

Such a system would use electromechanical sequencing for positioning and similar operations, tape control for machining step-by-step portions of the workpiece and template follower for machining a contoured part of the workpiece.

Numerical control will not give more accuracy, higher speed or better finish than those available from conventional lathes. It will, however, reduce cycle time and reduce errors through elimination of the human factor. Most tape controls are of the numerical or step-by-step finite positioning type. Analog or contouring systems are available which employ the magnetic principle, transforming voltages into positions over a continuous path rather than in discrete coordinate positions as in the numerical system.

An example of a lathe using magnetic tape for continuous path control is illustrated in Fig. 6. This Gisholt lathe is a transistorized, unitized, plug-in control and shows the advantages of miniaturization of controls. The machine is self-contained, requiring no remote control cabinets of any kind. Because of the miniaturized electrical control the machine is extremely compact. It is particularly

clean in appearance. No hoses for hydraulic lines are visible. The machining cycle utilizes a 2½-inch mylar base magnetic tape for continuous path control. Features of the lathe are particularly designed to simplify tooling and shorten setup time to provide for economical short-run jobs.

Drives: Because the trends have been toward bigger, faster and sturdier lathes with more functions and more controls it is apparent that horsepower requirements have multiplied. For instance, a 16-inch lathe required about 7 or 10 horsepower for its drive ten years ago. Today, a standard 16-inch lathe usually requires 20 horsepower. In addition such a lathe may be designed to operate at 30 horsepower during the cutting cycle. This is practical as well as economical because the cutting cycle is a fraction of the total time of lathe operation. In an application of this kind, it should be remembered that drive motors are rated conservatively for continuous duty and are capable of 50 percent overload for intermittent duty with safety.

In addition to increased horsepower, lathes have generally many more spindle speeds to meet machining needs for increased productivity as well as better surface finishes. The spindle speed can be selected within narrow limits for optimum cutting conditions, dependent upon workpiece size, workpiece material, tool material and tool geometry. On operator controlled lathes, many headstocks have provisions for preselecting spindle speeds to save that portion of cycle time during speed changes.

Ten years ago, cutting speeds ranged in the neighborhood of 125 to 400 fpm. Today, comparable speeds are about 250 to 1000 fpm using the same tool geometry and depth of cut but improved carbide tools and tougher workpiece materials. To

produce these speeds the comparable range of speeds for a 16-in lathe have increased from 1000 rpm max to 2000 rpm max and higher. At the same time, the choice of spindle speeds has more than doubled, having increased from 16 to 36 for a typical lathe.

A new heavy-duty lathe designed by Sidney Machine Tool Co. is shown in Fig. 7. It has a 75-horsepower drive and a selection of 36 spindle speeds. Controls are arranged for the convenience of the operator.

In machining exotic materials for missiles, cutting speeds of less than 50 fpm are currently being used. This potentially critical work uses speeds that have set us back 50 years. The problems and bottlenecks that may develop as the result of a military emergency seem frightening. There is an answer that must be found soon for the safety and security of everyone.

Higher spindle speeds involve design refinements to produce a better workpiece. In addition to the necessary horsepower and machine rigidity, factors of vibration and chatter are critical considerations. Not only must the spindle and its bearing be highly precise, but also the drive elements preceding the spindle must not induce vibrations. Also, the tooling and work geometry should not introduce vibrations at these higher speeds. In test runs, cutting speeds of 18,750 fpm were obtained with ceramic tools on a 150-horsepower lathe built by the R. K. LeBlond Co. Highly satisfactory results were obtained.

Users have long wanted an effective, economical and dependable adjustable-speed drive. Requirements for such a unit involve constant horsepower over a wide range of speeds. Such a drive, employing mechanical principles, has been applied by Nebel Machine Tool Corp. to their lathe.

Fig. 6. Compact and self-contained lathe designed by Gisholt utilizes transistorized controls and magnetic tape unit for contouring.



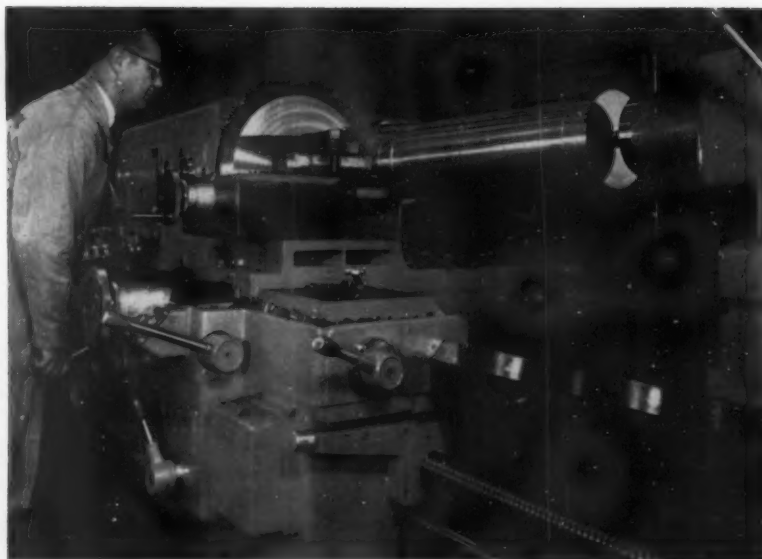


Fig. 7. Heavy-duty Sidney lathe cutting SAE 6145 with a Rockwell C hardness of 24-26. Surface speed is 288 fpm at 0.0835-inch feed and 1 inch depth of cut.

This 5-horsepower spindle provides infinitely variable speeds between 43 and 3500 rpm. The spindle itself has a 9:1 ratio from the planetary system. Another 9:1 variable ratio is obtained from a speed variator which uses a ball differential. Such a range of variable ratios gives the lathe a high degree of adaptability to radically different machining conditions.

Gaging: Five years ago, there was a popular trend toward self-regulating machines. Feedback control would adjust the lathe after each cut. This approach lends itself admirably to special machines with built-in loaders and unloaders. It is, in fact, a high degree of automation and can have statistical methods built into the gaging control. Such a system was the subject of an article in *THE TOOL ENGINEER*, Aug. 1955.

Finishes and Tolerances: A decade ago, lathes were not capable of utilizing the potential of carbide cutting tools then available. About five years ago, when ceramic tools became commercially available, few production tools could use them advantageously. With the recent addition of titanium carbides to tool materials and the new designs in lathes, it seems that machines are now on a par with the capabilities of the cutting tools. Improvements in one field always have a tendency of playing leapfrog with related developments in other fields. Lathe design and cutting tool design serve as good illustrations.

With each improvement in lathes and tools, finishes and tolerances have improved accordingly. Tolerances in a machine are cumulative. For instance, a tape control system may have a guaran-

teed accuracy within 0.001 inch. When the tolerances for the tooling and mechanical elements are added, the inherent dimensional variations are beyond the usual tolerances for precision work.

Tolerances of 20 to 30 millionths inch are frequently expected. Yet it is a good lathe that can hold taper within 0.0005 inch in 36 inches. In an inch of travel the lathe carriage alone has used up the tolerance allowed.

Finishes on turned parts approach those obtained on grinders. To save an additional operation, the objective of many tool designers has been to obtain such finishes in production. This has proved practical in many applications, giving finishes as smooth as 20 microinch.

Modern lathes have stability built into them and often do not need concrete foundations. In the past, large machines have required foundations of 6-ft concrete. Machining errors introduced by the foundation mounting were necessarily compensated for by the operator. Now, with operator control minimized by automation, together with desired flexibility of machine positioning and location, the need to make the machine self-contained and self-supported is evident.

Acknowledgments

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MORE HOLES FEWER FIXTURES

—improved tooling and controls

PAY OFF

By Daniel B. Dallas
Assistant Editor

Modern cutting tools and control systems applied to drilling and boring machines of advanced design have increased productivity while minimizing tooling requirements.

MODERN HOLE-MACHINING techniques, like other aspects of metal removal, reflect 1960's drive toward higher efficiency. Among the more important developments are better carbide and ceramic boring tools, improved machine drives and feeds, use of numerical control and new concepts of design and of the hole-machining operation itself.

Economic considerations accelerating these developments are chiefly due to two related facts of modern industrial life. Skilled labor has been in short supply since World War II; where skilled labor is available, it is rapidly becoming more expensive. Required to produce more products having increasingly closer finish and dimensional tolerances with semiskilled operators, industry has responded with entire new families of drilling and boring machines and has departed from the traditional jig-and-fixture concept of hole machining.

Although jigs and fixtures for hole drilling and boring have not passed entirely from the industrial scene—nor will they in the immediate future—the role they play is one of diminishing importance. Happily divorced from the major production lines, their demise has freed industry from the restrictions of long lead-time requirements, problems of heavy part loading and tool handling, and the difficulties inherent in making engineering changes.

Cutting Tools: The implication of cutting tool advances, as represented by the carbides and ceramics, is that the older, conventional machine tools are now as obsolete as the overhead belt drive. The practical criterion by which they can be measured is whether or not they can utilize carbide or ceramic cutting tools.

As typified by throwaway insert tooling, the carbides and ceramics have changed another basic concept regarding machine tools. Formerly, tool life was the all-important criterion in boring operations. As such, machine tool efficiency was subordinated to cutting-tool life. This concept is no longer valid and industry should run its tools at a red heat. Economically, the fact that this procedure burns tools up at a faster rate is outweighed by increased machine productivity.

In order to capitalize on carbides, a machine must have approximately twice the horsepower required for high-speed tools. To utilize ceramics, horsepower requirements are quadrupled. These additional power requirements impose greater demands upon the machine tool itself. As a result, modern drilling and boring machines, such as the one shown in Fig. 1, are designed to withstand greater strains than those produced before the advent of carbides and ceramics.



Fig. 1. Vertical-spindle mill machining tractor components. Tool selection at magazine (center) is a programmed function of the machine.



Fig. 2. Turret head for drilling machine. Lead-screw drive is used to actuate tapping unit.

Fig. 3. (right) Special tooling in trunnion machine. In this machine feed rate can be controlled for each tool.

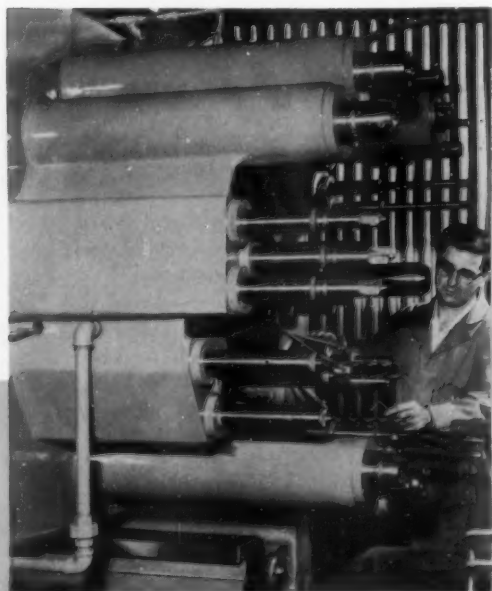
Drives: Because optimum speeds for carbide and ceramic tools are normally unobtainable with conventional gear drives, variable-speed drives are desirable in modern boring machines. Drives of this type enable operators to increase spindle speed without stopping workpiece motion. They also provide a much greater range of cutting speeds, a necessity because the range of materials machined on any given machine now extends from cold-rolled steel to the exotics.

To obtain the desired characteristics of infinitely variable speeds at constant horsepower and constant torque, Bullard Co. has developed a new mechanical-hydraulic drive for its vertical turret lathe. In this unit a mechanical input drive is geared to a hydraulic reactor input through two planetary gears. The machine drive itself is taken from the motion of the planetary cage. The spindle speed can be varied from zero to 1550 rpm merely by changing hydraulic flow to the reactor. Thus, when the reactor and the constant-input gear are traveling at equal speeds, the speed from the differential planetary is zero.

Drives of this type are more versatile than either mechanical or hydraulic drives because:

1. Straight mechanical drives cannot be reduced to increments approaching zero.
2. Straight hydraulic drives have difficulty in maintaining constant torque at increments approaching zero.

To further increase the versatility of this drive, a servo feed-back system is utilized to maintain pre-selected rates of metal removal. Should the tool enter an area with an increasing or decreasing



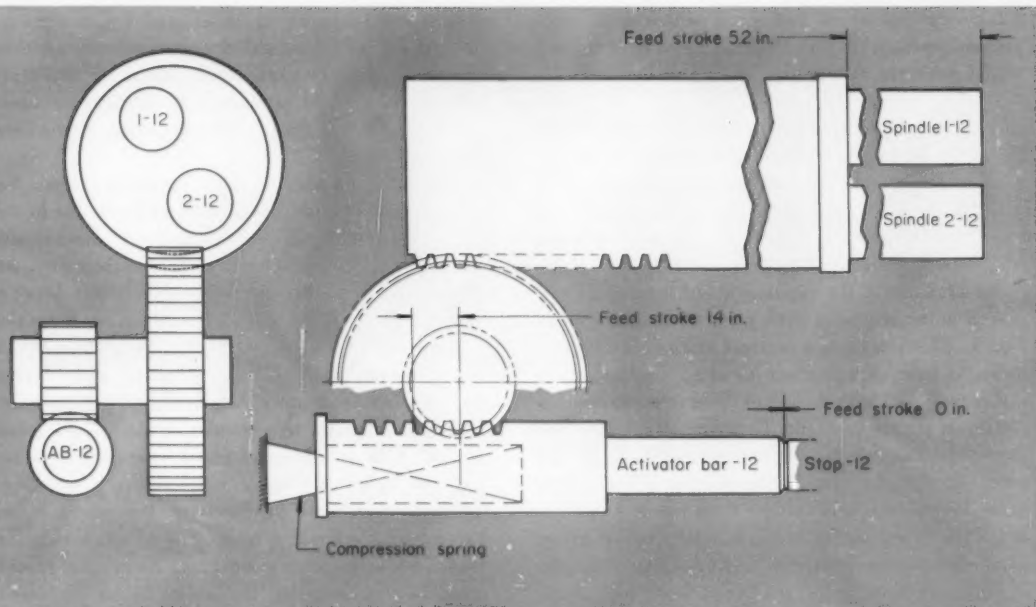


Fig. 4. Mechanism for activating spindle advance. Spindles advance with head until activator bars contact the stops to initiate quill feed.

volume of metal, the servo automatically corrects spindle speed by adjusting the volume of hydraulic flow to the reactor gear.

Feed Mechanisms: Like machine drives, feed mechanisms have been improved to take advantage of carbide and ceramic cutting tools. Carbides, for example, function best under heavy feed rates at comparatively high speeds. Ceramics function best under relatively light feed rates but at speeds up to twice that required for carbides. At the same time, feed mechanisms must provide for high-speed tools which are still economical for many operations.

With this array of machining variables, the traditional linkage between workpiece drive and feed mechanism can no longer fulfill the requirements of modern machining. The optimum feed rate for any given job is either bracketed or outside the range of conventional drives. For this reason, the feed speed of modern boring equipment is usually independent of the spindle drive.

To obtain optimum feed rates, industry has designed a variety of feed mechanisms tailored to the specific needs of boring and drilling equipment. Bullard's new feed mechanism utilizes the same mechanical-hydraulic planetary movement used in its variable-speed table drive. This provides its turret lathes and boring mills with infinitely variable feed rates which can be selected while the machine is in operation.

Also, Burg Tool Mfg. Co., has developed a hydraulic system which enables its line of turret drill-

ing machines to feed at infinitely variable speeds. Tool feeding at the turret is positive and constant throughout any given phase of the machine cycle. This development includes a leadscrew tapping head, Fig. 2, which relates spindle rotation and advance to the pitch of the thread being machined.

One of the more significant developments in mass-production drilling and boring is in the feed mechanism of multiple-spindle trunnion machines. Until recently, fixed feed rates were the major limitation on machines of this type, Fig. 3.

Because these machines are most efficient with one feed unit only—more than one detracts from the natural advantage of the machine—conventional trunnions limit the rate of spindle advance to that of the slowest tool. Because of this limitation, tools such as reamers (which are more effective when advanced rapidly) are forced to move forward at speeds selected for drills or cutting tools.

To overcome this weakness, Cross Co. has developed a gear system which enables drilling and boring quills to advance at optimum rates of speed although the head itself still advances at a rate suitable to the slowest tool. In operation, this gear system utilizes a series of activator bars (one for each quill) and pinion gears, Fig. 4.

As the head advances to the point where machining starts, a bar activator contacts its stop button. At this point, the bar imparts motion to its pinion gear. Rotation of the pinion gear moves the quill forward at a rate determined by the speed of the feed unit and gear ratio. Upon completion of the

machining operation and head withdrawal, compression springs return all the activator bars to their initial positions in the head.

Multiple-Hole Machines: Multiple spindle drilling and boring machines such as the trunnion machines are symbolic of the increasing productivity of 1960. Now fully emerged from the developmental stage, machines of this type might eventually eclipse the transfer line in many areas of production.

An example of the capabilities of such machines is seen in the precision boring machine illustrated in Fig. 5. This machine, a product of Ex-Cell-O Corp., bores 22 holes in a gearbox housing. The operation is accomplished with the use of three interchangeable plates on which 5, 7 and 10 multiple spindles are mounted. Two machine setups are required. In the first operation five large holes are bored simultaneously to tolerances of 0.0005 inch. Hole locations are taken from dowel holes and the workpiece is hand clamped in a simple holding fixture. In the second operation, holes are bored from both sides of the workpiece simultaneously. A seven-spindle plate bores from one side and a 10-spindle plate mounted in opposition bores from the other.

Time requirements for this operation, formerly accomplished by conventional toolroom techniques are one day per part. With a multiple-spindle

machine, time requirements are reduced to a matter of minutes with a semiskilled operator. Economies in time and labor make multiple-spindle machines the inevitable and perhaps the ultimate successor to the jig borer in the production boring of precision hole groupings.

When the number of holes required exceeds the capabilities of multiple-spindle machines (as in the case of printed circuits) high-speed, numerically controlled drilling machines come into their own. An example of this is seen in Fig. 6, in which a Jones & Lamson machine positions and drills forty holes per minute per spindle. The spindle cycle time is 0.3 sec. This machine utilizes six spindle heads driven by 400 cycle motors which run continuously. Mounted in pairs, one spindle is idle as the other works. This arrangement enables setup men to re-tool idle spindles without interrupting production. To further increase productivity, the machine has two removable floating tables, one of which is being loaded while the other is working. As in other recent machine developments, the accent is on increased productivity with minimal labor requirements.

Deep Holes: Techniques in the drilling of deep holes have also evolved significantly. An example of this is seen in the LeBlond-Carlstedt boring machine shown in Fig. 7. This machine embodies such improvements as infinitely variable spindle speeds and feed rates, increased structural strength required for machining with carbides and ceramics, and numerically controlled operation.

An interesting aspect of this machine operation is its method of chip disposal. As chips form and break off, they are flushed through the hollow boring bar by the coolant flow, Fig. 8. Removal of chips by this method reduces the interference and congestion usually found in the machining of deep holes. It also eliminates the surface abrasions which chips cause when escaping conventionally.

Upon discharge of the coolant into an enclosed filtering system, the chips are removed magnetically and carried away by a conveyor. The coolant is then circulated through a chilling system which



Fig. 5. Multiple-spindle drilling and boring machine. Holes on both sides of workpiece are bored simultaneously by opposing feed units.

Fig. 6. (right) Drilling machine for printed circuits. Two-dimensional movement of table positions work according to taped commands.

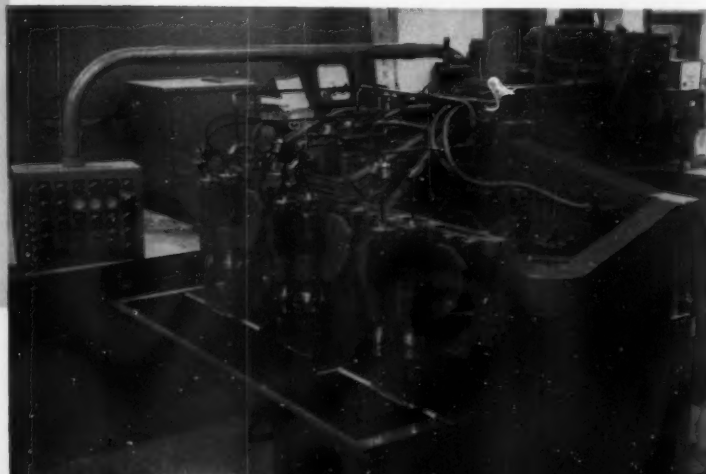
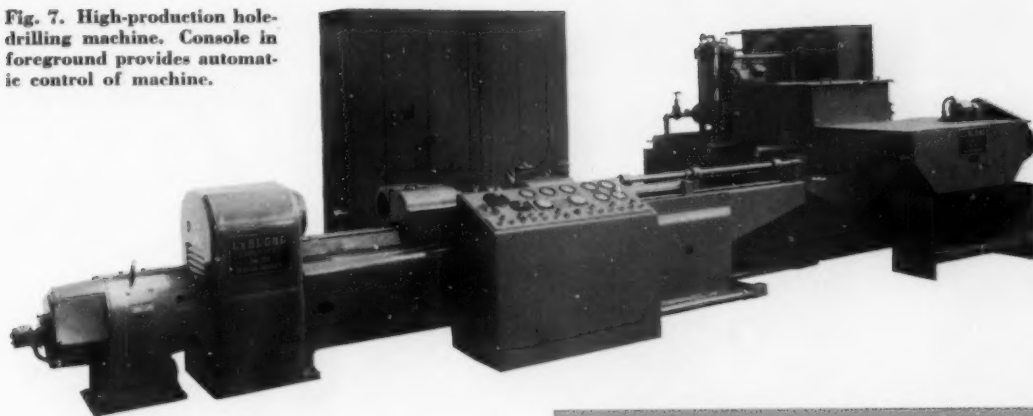


Fig. 7. High-production hole-drilling machine. Console in foreground provides automatic control of machine.



reduces its temperature. This effectively eliminates the recurrent problem of workpiece expansion.

When extremely long holes are machined, automatic bar supports stabilize the bar and dampen vibration. Operated hydraulically, these supports are necessary because of the comparatively high feed rates now used. As an example, before this machine was built, its predecessor bored holes $1\frac{1}{2}$ inch in diam in 1150 steel at the rate of $\frac{3}{4}$ ipm. This machine performs the same operation at 6-7 ipm.

Although this machine was designed to drill long holes, it is essentially a general-purpose machine which has evolved from the basic engine lathe. In addition to its drilling ability, it can counterbore and trepan with equal facility while maintaining the same coolant-flow method of chip disposal.

Control Systems: Although the numerous applications of numerical control have received extensive coverage in *THE TOOL AND MANUFACTURING ENGINEER*, any article on drilling and boring techniques must recognize this subject. With the possible exception of carbide and ceramic cutting tools, no other development has accomplished so much in changing modern industry. Most of the machines discussed thus far are actuated by numerical control. In practice, any machine not designed for one special purpose represents a potential application of this type of control system.

An excellent example of the versatility of numerically controlled machining is seen in the Lucas drilling and boring machine illustrated in Fig. 1. All machine functions, including tool selection, can be programmed on tape. This reduces operator functions to part loading and unloading, and cutting tool maintenance.

In advancing to programmed machining positions, a tool moves at rapid traverse of approximately 75 ipm. Upon approaching the start point, the tool shifts into a creeper speed which allows exact positioning. If, however, exact positioning is not re-

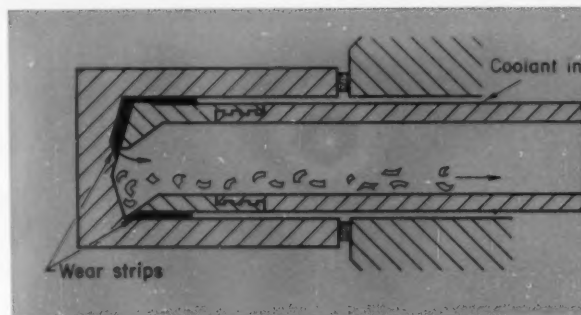


Fig. 8. Chips are removed through center of boring bar. Coolant is fed between bar and work. Wear strips stabilize boring tool in deep-hole operations.

quired, a command to cancel the creeper speed can be programmed.

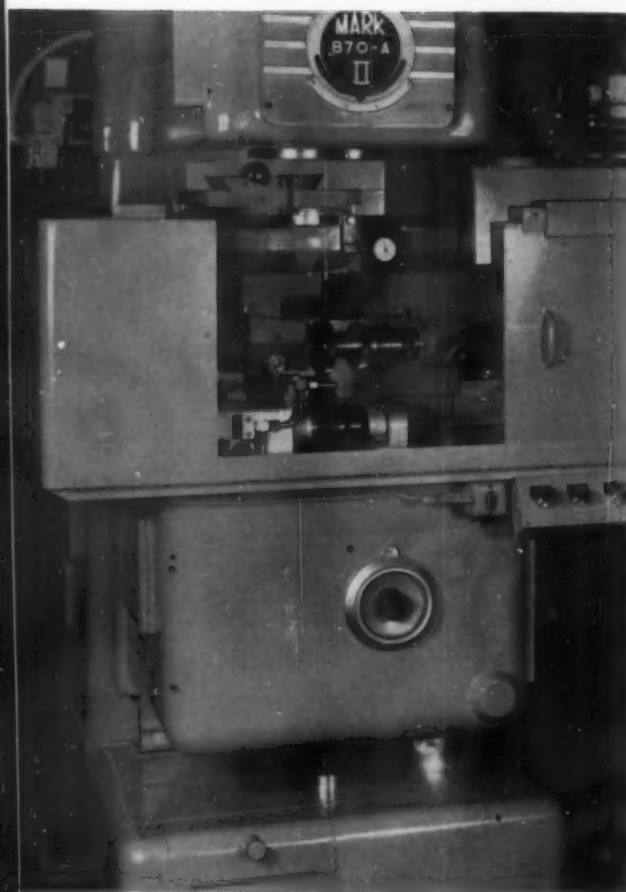
A useful auxiliary function of this control system is instantaneous tool reversal and retraction during tapping operations. When the programmed thread depth has been reached, the spindle reverses rotation and withdraws with no time lost in tape reading. When the tape starts to back out, the retracted position data is read into the control and the tool retracts to the desired location. This same function may be used with boring, drilling and reaming tools without the need for spindle reversal.

Another feature of this control system is its ability to program tool selection. Tools are stored in a magazine and their positions are programmed. Upon completion of one operation, the spindle moves to the magazine and releases the cutting tool used. It then progresses to a different magazine position and picks up and clamps the next tool in the sequence.

Because numerical control now dominates production boring and drilling processes, the more difficult problems in this field have been reduced to routine machine operations. While increasing productivity, numerical control has also accomplished much by way of eliminating the variable of human error. Although its total impact has yet to be assessed, it probably embodies the most promising advance in machine control within the last decade.

designed for **PRODUCTION**

Dial Settings Control Gear Shaver



MACHINE set up to shave helical gears. Dial on head controls transverse feed movements during shaving.

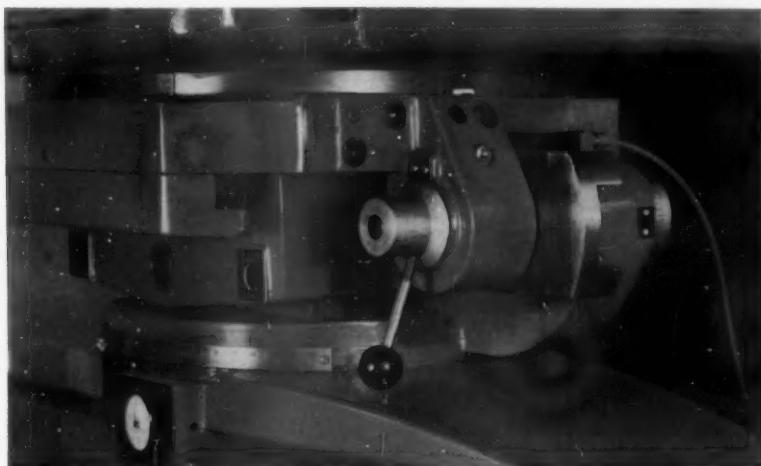
FEED CONTROLS for each of the three methods of gear shaving.

Gear shaving by underpass, modified underpass and transverse methods is controlled by dial settings in this machine. A product of Michigan Tool Co., the shaver can be set to crown or taper the teeth during shaving by a scale setting and a graduated eccentric bushing. The latter two adjustments are independent of each other, making possible any desired combination of crown and taper.

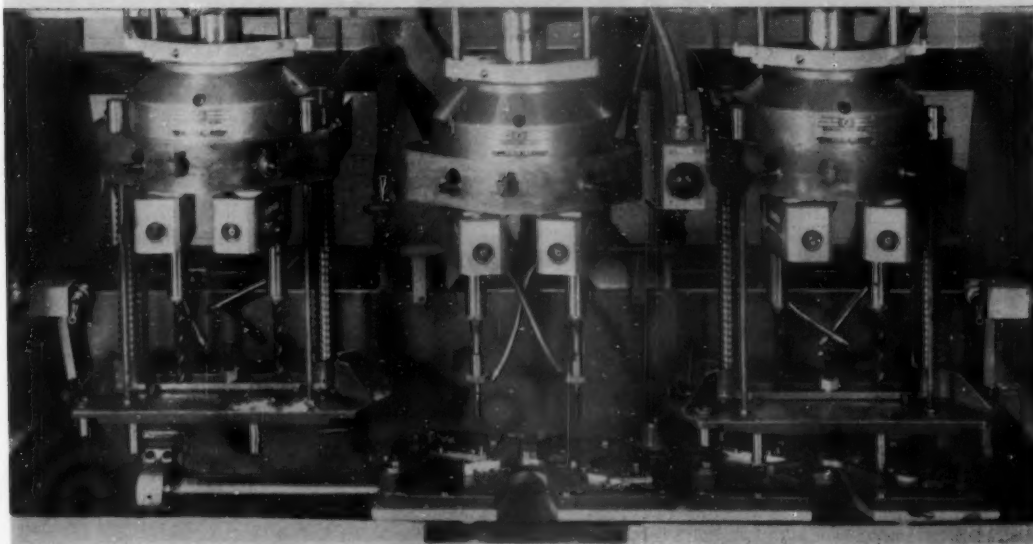
Because of the use of dial controls, machine setup is reduced from a complicated problem in cam setting to a series of dial adjustments.



ATTACHMENT for crown and taper. Dial setting at right controls taper. Vernier at left controls fine lead adjustments.



Shuttle Fixture Increases Tap Efficiency



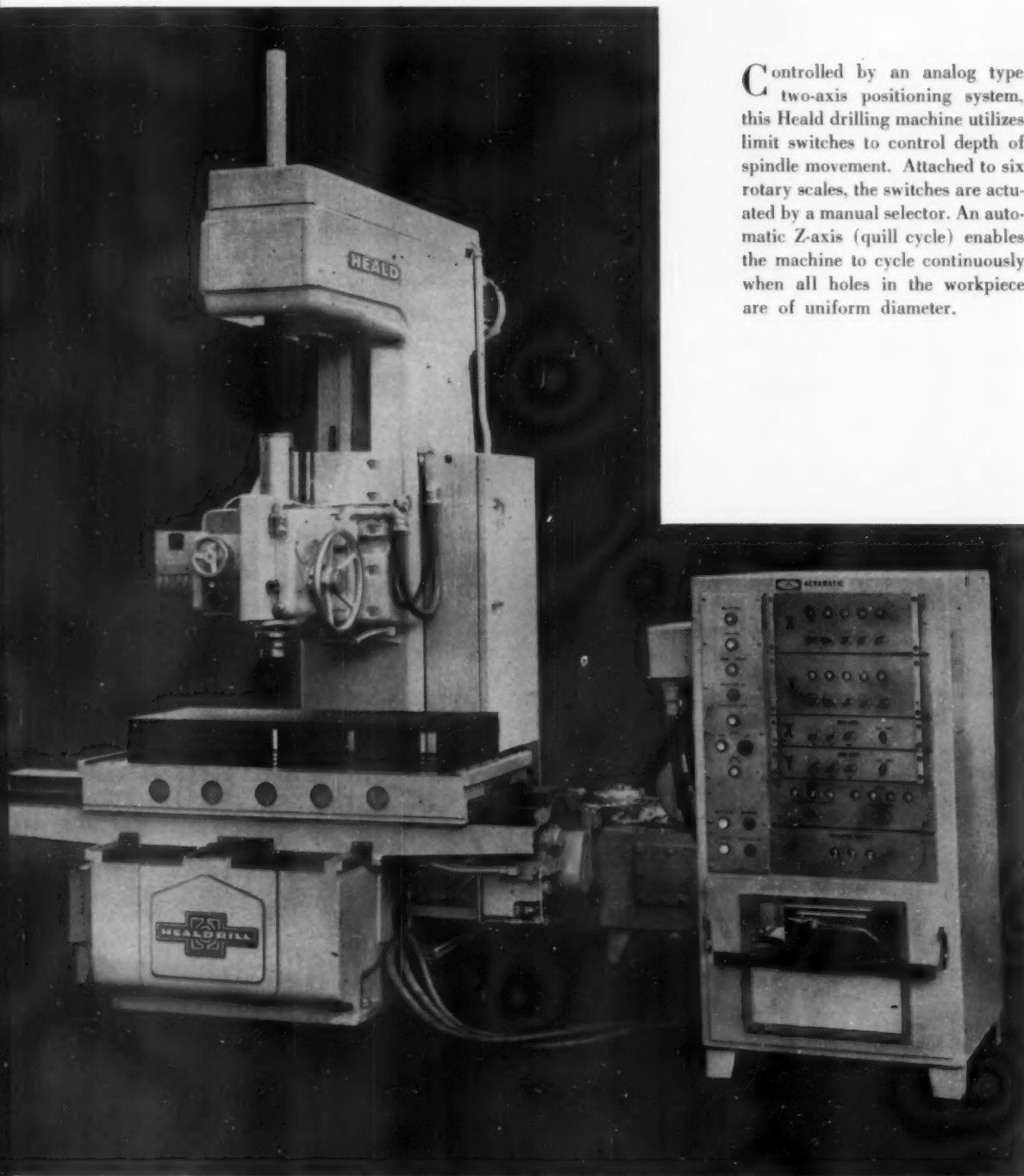
Increased efficiency in small production runs is provided by the unusual design of this two-way shuttle machine. Built by Zagar, Inc., Cleveland, its machining components consist of two drilling heads and a central tapping head.

In operation the two-station fixture alternates between the two drilling stations, thereby always presenting a drilled workpiece to the tapping station after each indexing operation. Immediately after part loading—which always takes place at the tapping station—the fixture shuttles and machining begins.

DESIGNED FOR PRODUCTION

Drilling Machine Provides Accurate Hole Depths

Controlled by an analog type two-axis positioning system, this Heald drilling machine utilizes limit switches to control depth of spindle movement. Attached to six rotary scales, the switches are actuated by a manual selector. An automatic Z-axis (quill cycle) enables the machine to cycle continuously when all holes in the workpiece are of uniform diameter.

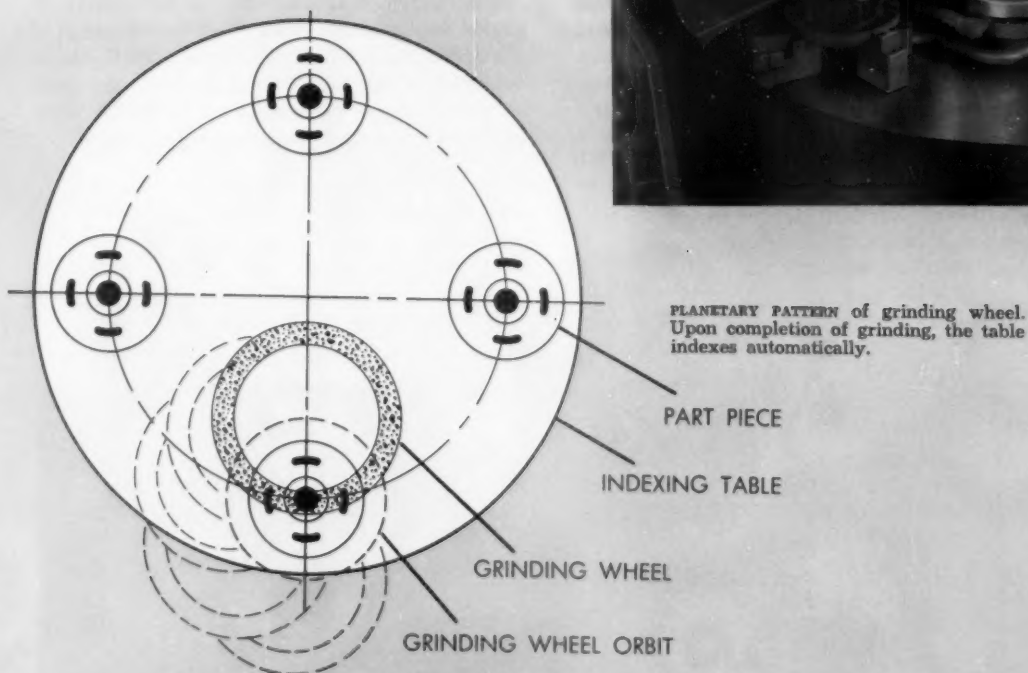


Surface Grinder Has Planetary Wheel

Accurate part orientation and simplified fixturing are possible in the Mattison surface grinder illustrated. Like conventional vertical-spindle surface grinders, this machine utilizes the principle of revolving contact between workpiece and wheel to produce a flat surface. Unlike the conventional grinders, this machine provides the revolving contact by a planetary wheel. Use of this wheel simplifies machine design by eliminating the separate drive necessary for spinning the work.

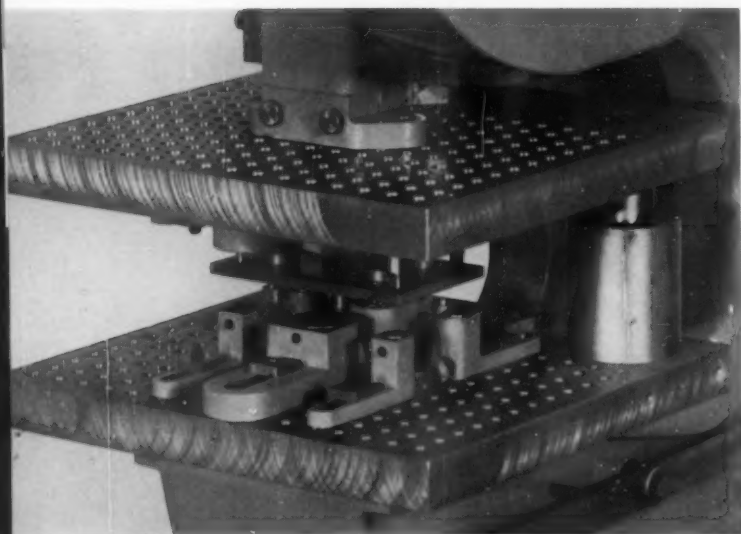
The planetary wheel head is designed to house either one or two spindles. An auxiliary motor drives the spindle assembly while the main wheel motor powers the spindle through a timing belt which revolves radially.

PUMP COMPONENTS (right) fixtured for grinding. Gage probe at left actuates feed to compensate for wheel wear.



DESIGNED FOR PRODUCTION

Adjustable Die Cuts Tooling Cost



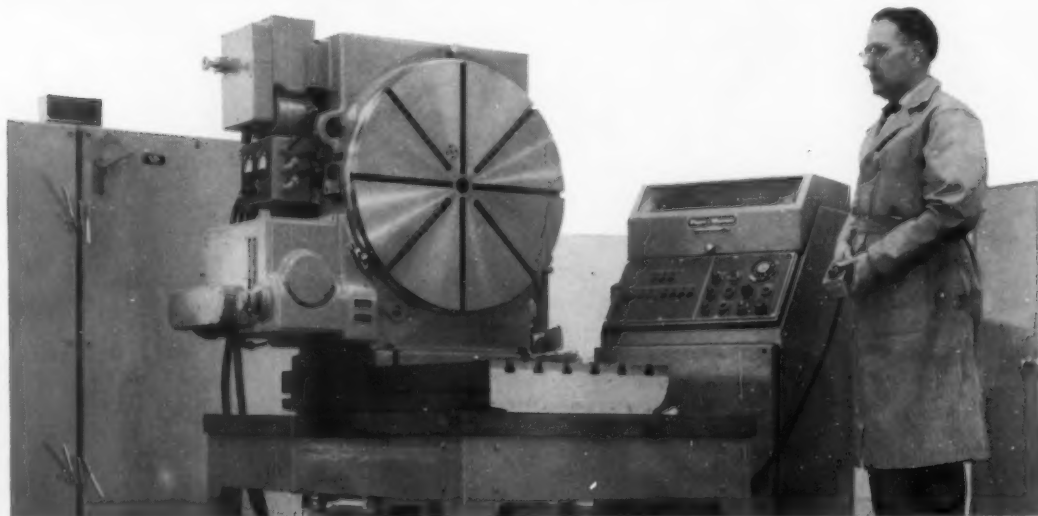
Designed to minimize tooling expense in piercing operations, this Di-Acro die can be utilized to pierce holes in a wide variety of panels. Changeover from part to part is simplified by movable punch and button-die adapters.

In setup, punch-and-die locations are established by part templates or panels saved from previous runs. With the exception of stripper plates, no new components are required.

Telephone Dial Controls Rotary Table

Capable of automatically positioning to any point in 360 degrees, with accuracy to 5 seconds of arc and repeatability to 2 seconds of arc, this 30-inch rotary table can be used for either inspection or machining. Digital positioning information is introduced by telephone dial or by punched coded tape.

Rapid rotation is accomplished by pushbuttons. A digital display panel gives a visual representation of the table position. All positioning is accomplished in relation to a preset zero, which can be set anywhere on the periphery. The table, made by Pratt & Whitney, uses Electrolimit measuring system.



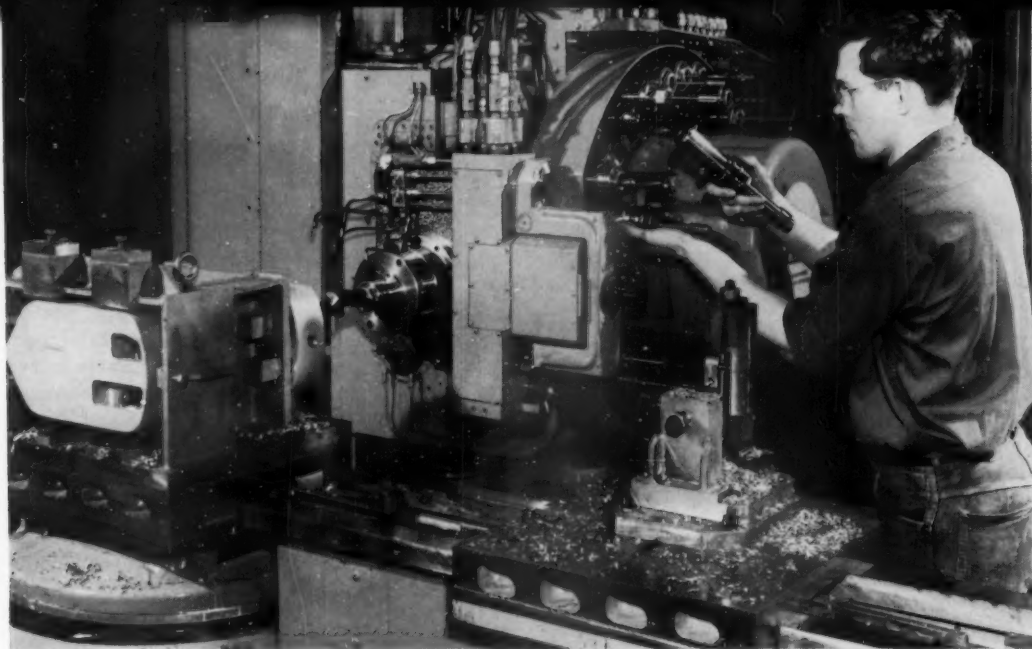


Fig. 1. This milling machine is designed for a variety of metal-removal tasks. An automatic tool changer stores coded and preset tools to be used as the job requires.

MILLING

—bigger cuts, better controls

By Robert Heslen
Associate Editor

Modern milling machines cut metal faster and more of the machine cycle is used for cutting. Result: one of the newer milling machines can outperform several older machines and it is more versatile.

VARIETY in machine configuration and application causes some confusion of ideas when milling is discussed. Basically milling is a process that uses a group of cutting edges or single-point tools grouped radially about an axis and turned, the tools removing chips from the material as they come in contact with it. The first machine specifically devised for milling is that of Eli Whitney, made around 1820. From this antecedent derived the Lincoln miller of 1855, prototype of later bed type production milling ma-

chines and Brown's universal milling machine of 1861, forefather of knee type universal milling machines. The two basic types of milling machines have undergone continuous development to emerge as the two major types of milling. The universal miller today is one of the most versatile machines ever known. On the other hand, bed machines have evolved into special-purpose high-production machines that are highly efficient. Between these two extremes lies a variety of machine configurations such as shown in *Fig. 1*, for milling and other operations. The process is typified by the variety of applications possible. A machine operator's job varies from simple loading on a production machine to a job involving great skill and ingenuity, using a universal machine as shown in *Fig. 2*.

Machinability: Though machine tool configurations vary widely, the milling process is always characterized by the cutting tool, a rotary arrangement of cutting edges. Advantages of this cutting method, as compared to say single-point turning, are

that many cutting edges are available to do the work instead of only one and that a cutter tooth has a chance to cool once during each revolution when not in contact with the workpiece. Disadvantages are the repeated shocks as each cutting edge comes in contact with the workpiece. Brittle cutting materials do not stand up well under this kind of service. Use of ceramics in milling cutters has been somewhat retarded by the problems caused by repeated impacts occurring in milling. Rigidity is essential for removing metal in this interrupted fashion and has been part of the reason for developing milling machines with overarms, box type overarms, overarm supports and bed type machines. Arbor-mounted flywheels are used for the shock damping provided

by their added inertia. Another recent development is an attempt to hold the cutter more rigidly on the arbor, *Fig. 3*, to resist vibration and chatter tendencies. The splined arbor has greater resistance to torsional deflection than plain arbors. Also, a splined cutter on a splined arbor has a greater seating area than a key-held cutter.

Anticipating higher metal removal rates, whether from ceramics or carbides, millers are being built with more horsepower available at the spindle and drives. Some of the newer missile materials are cut in optimum fashion in only a precise and narrow range of feeds and speeds. Responding to this need, machines are designed with both precise accurate controls and rigidity.

Investigations of machining phenomena have been carried on consistently since Frederic Taylor's work in 1906. Such work and the improvements in machines, cutters and know-how has increased the rate of metal removal 30 to 50 times since then. Metallurgical microstructure, machinability, cutting tool geometry, coolants, carbides and ceramics have all contributed to greater efficiency in milling.

Nonetheless, it is significant that today the common practice is to select conservative cutting rates. Any given milling job admits of one specific optimum solution and this solution can be of minimum efficiency in another job.

The difference between common practice and the specific optimum solution lies in the difficulty of finding the optimum solution. Recognition of this difficulty has led to work on machinability computers—so far of relatively simple analog type construction. It has been proposed that the problem of finding optimum milling conditions would best be solved using a large digital computer in which available

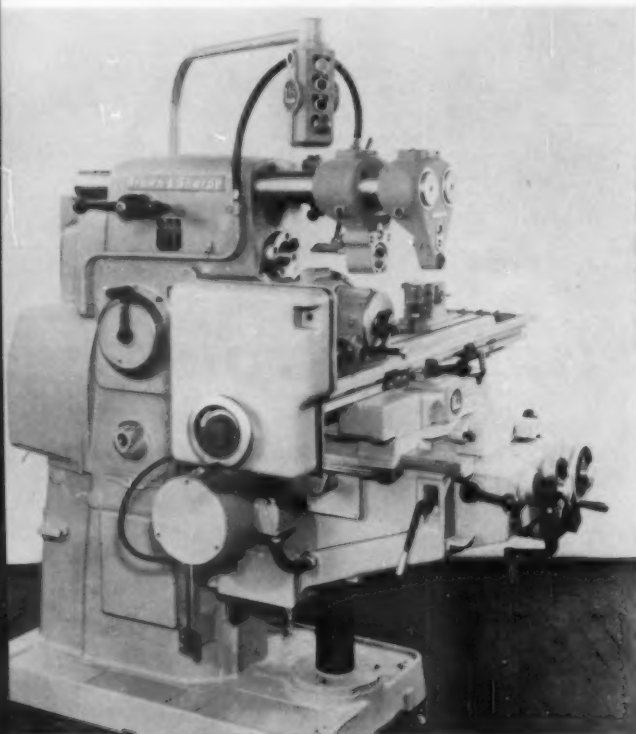
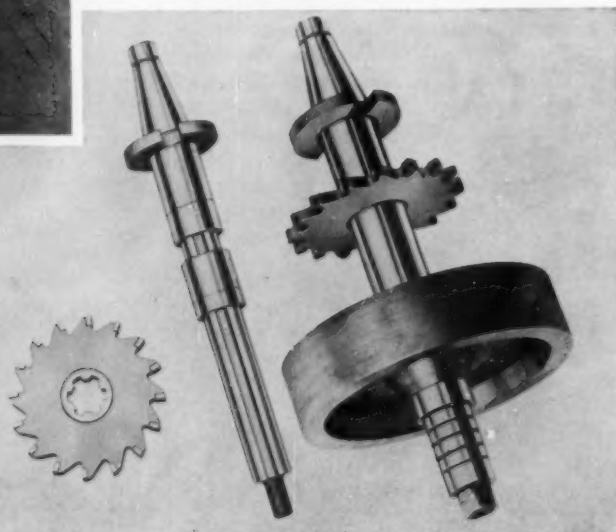


Fig. 2. (above) Universal milling machines are characterized by their versatility. Almost any configuration can be machined.

Fig. 3. (right) Splined arbors and cutters have additional rigidity to resist the repeated impacts of milling.



information regarding metallurgy, cutter materials, feeds, speeds, coolants and so forth would be stored. Proponents of this method recognize that there is some doubt whether enough is known today about milling to supply the computer with adequate and accurate information. This has led to the exploration of another method. One investigator seeks to determine whether there is some fundamental basic characteristic of metals that would enable tool engineers to know machinability characteristics without having recourse to the usually expensive empirical method of conducting cutting tests.

Combined Operations: Since it does not presently appear possible to eliminate milling, there is one viewpoint that milling is a necessary evil to be endured simply because it is necessary in manufacturing. This viewpoint has been fertile and has led W. Brainard and his associates to the realization that greater efficiencies could be realized by focusing more attention on the over-all problems of making a part and less on the individual operation. To demonstrate the validity of this approach, *Fig. 4* shows several different tools for several operations grouped in a magazine, available to do a variety of operations on a given workpiece. Combining other operations with milling in a given machine tool saves setup time, fixturing, material-handling time, and enables greater over-all manufacturing efficiency. A similar adaptability to a variety of manufacturing jobs is shown in *Fig. 5*. This Sundstrand rail type machine has a capacity of 20 tools of 3-inch maximum diameter, giving it high versatility.

Versatility with Efficiency: All of these machines are numerically controlled. The Brown & Sharpe universal miller, *Fig. 2* can be equipped with a numerical control arrangement that renders it especially efficient for cam work yet does not impair the basic versatility of the machine. The Milwaukee-Matic is a new concept that has not existed except in the numerically controlled version. Use of numerical control is part of the effort to make milling machines self-managing—a trend that started with Eli Whitney's miller that was equipped with a worm-screw feed, belt-driven as a function of spindle speed.

One of the most significant improvements in milling has been in handling the information used in milling via numerical control. By this means the flexibility of universal machines can be combined with the efficiency of special purpose high-efficiency production machines. Each tape renders a miller a special purpose tool, yet the basic tool remains highly adaptable to a variety of jobs. A well-developed example of this trend is the Sundstrand 5-axis Omnimill, *Fig. 6*.

The diagram of axis movement, *Fig. 7*, shows that it is possible to machine five of the faces of a cube

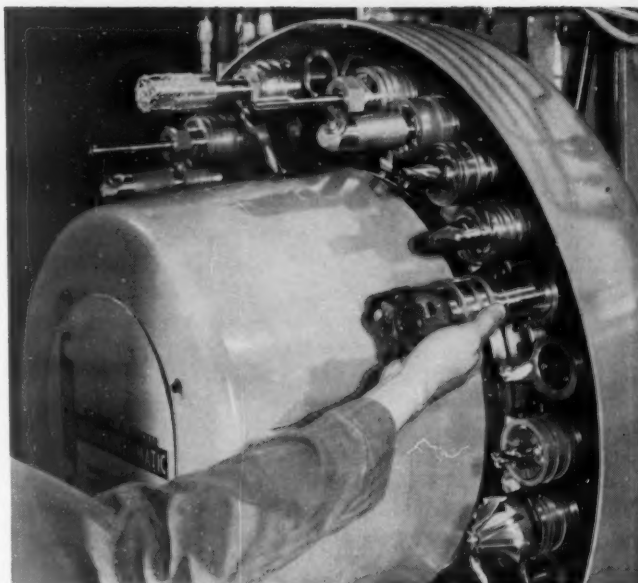


Fig. 4. The tool changing magazine stores the many other tools required in addition to milling cutters for complete manufacture of a part without moving the workpiece onto different machines.

in one setup. Machining can be done at almost any angle without using sine bars or changing the setup. With appropriate tools in the toolholder, the milling machine quickly becomes a machine for boring, drilling, reaming or tapping, still without changing the setup. Five axes of movement and an automatic tool changer render the machine flexible, inherently capable of handling a variety of jobs. The tape serves essentially, to specialize the machine, to make it produce some specific part efficiently, either for long or short runs. A wide range of spindle speeds

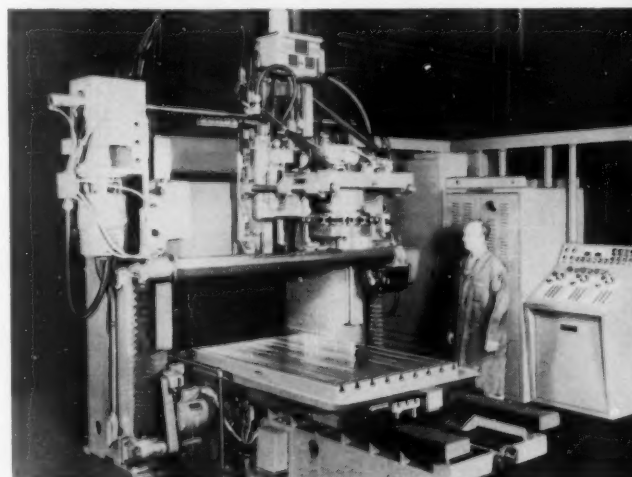


Fig. 5. Positioning control, tool changer and rail type configuration combined give versatility.

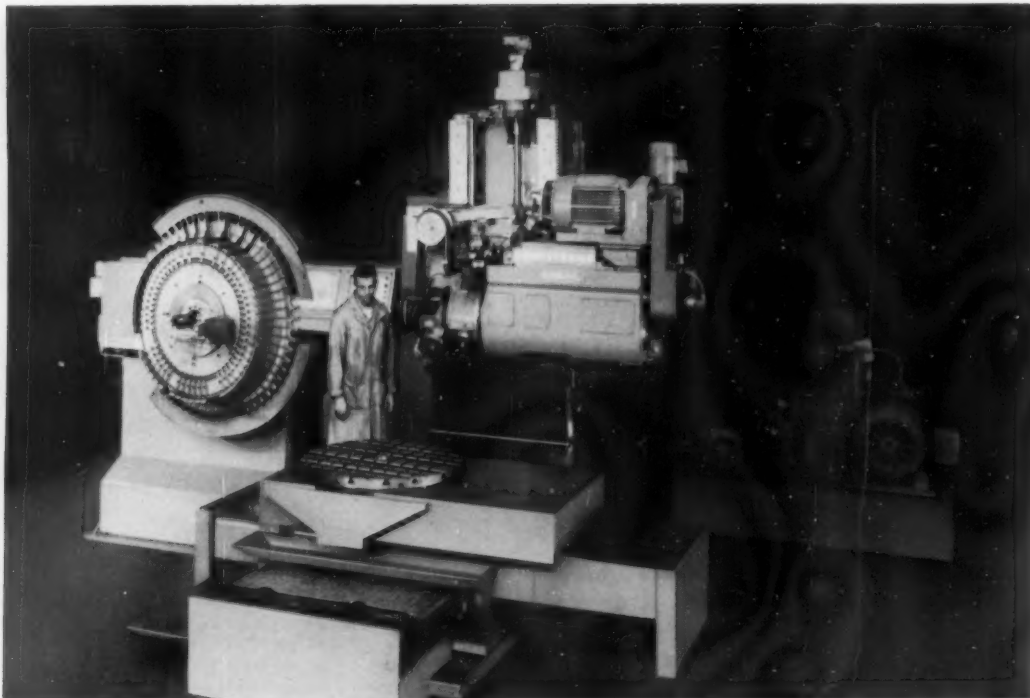


Fig. 6. An automatic tool changer, continuous path tape control and five axes of movement make the Omnimill both versatile and efficient.

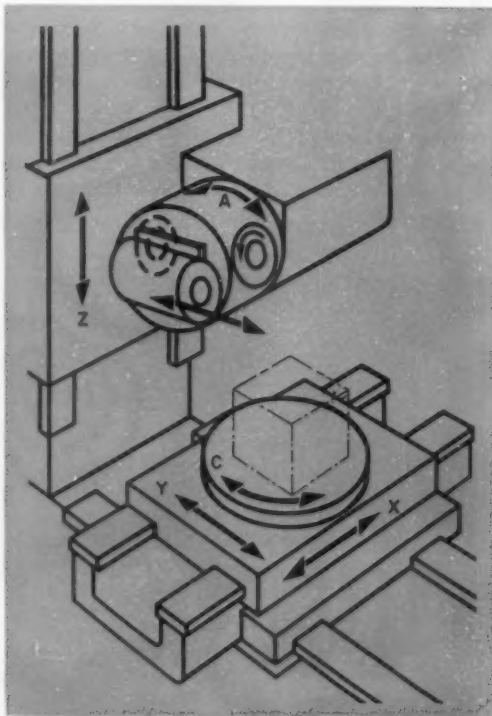


Fig. 7. Five axes of movement make it possible to machine five faces of a cube and to work at compound angles without changing the job setup.

is available in the machine, so that it can operate under optimum conditions for a wide variety of materials and cutting tools. Though a computer is probably more efficient, the Thompson-Ramo-Wooldrige control system used with the Omnimill can be hand programmed if desired.

Machine Utilization: Considering milling as a separate operation or as part of an over-all manufacturing task, considerable gains in efficiency can be obtained by improving machine utilization by better management. Numerical control in general contributes toward better management. The tape itself, insofar as it is canned experience, is retrievable for use at any time, which is better management than spending man-hours to solve the same machining problems twice. Further, the tape can be prepared, mistakes corrected and the tape optimized prior to the actual cutting so that machine utilization is efficient. Also, the tape makes manufacturing efficiency less dependent on operator skill.

Because a numerically controlled machine functions under an operator's general surveillance and does not require constant manipulation and attention, numerically controlled milling machines can be designed for time-sharing operations. That is, during the time that the machine is working, the next job can be set up, as in Fig. 8, to be shuttled into work position automatically, with little time

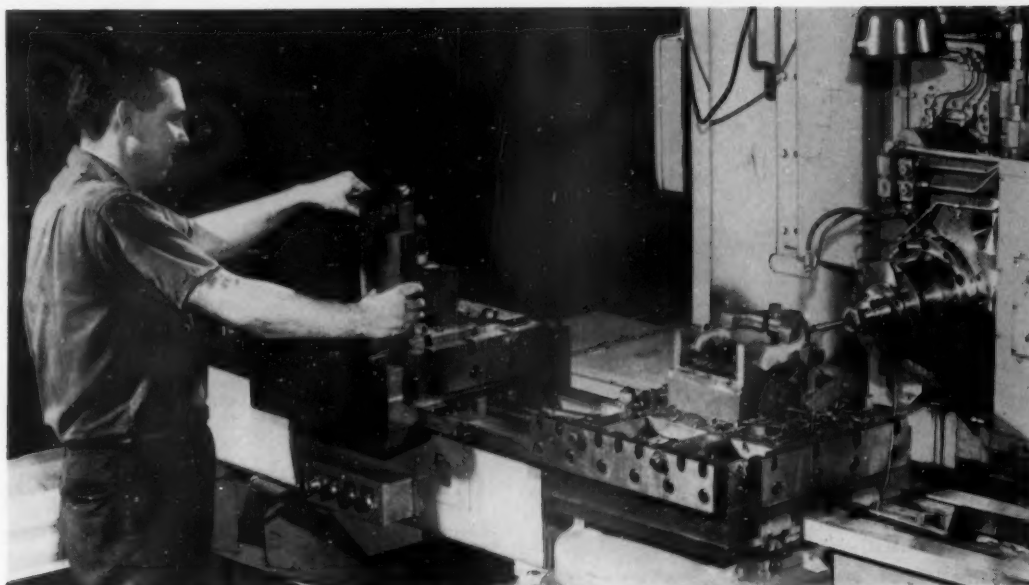


Fig. 8. The pallet enables setup of the next workpiece while the first workpiece is being machined. When the first piece is finished, the new job is shuttled into work position with a minimum interruption of machining.

lost on job changeover. Similarly, while the machine is working, preset tools can be loaded into the magazine or removed from it to meet varying job demands before they occur. Time-sharing, doing setup, tool changing and other work while the milling machine is running is more productive than the conventional time-sequenced type of manufacturing operation.

Machinability and cutting methods are undergoing modification as a result of experience with numerical-control milling. Because of the variable quality of cutting tools, nonuniform machinability of workpieces, most control systems are equipped with a device that allows the operator to vary the tape programmed feeds. The need for this control emphasizes nonpredictable factors in milling. Because of nonuniformity and variability, conservative cutting rates are usually selected—perhaps one-third slower than they could be with uniform tools and workpieces. Further, the unpredictabilities that force use of a feed-rate override make milling efficiency partially dependent on operator skill, and this on machines that are otherwise programmed to operate at high efficiency independently of operator skill. Research work is underway to minimize nonpredictable factors to increase metal removal rates.

Paradoxically, the management of cutting conditions in milling machines has become critical under numerical control because such machines produce considerable value per hour of operation. Interference and delays in operation thus appear to cost more than usual. For example, assuming that a given numerically controlled mill produces five times

faster than its conventional predecessor, downtime for a broken cutter "costs" five times what it did previously. Similarly, off-dimension cutters, coolants that do less than maximum, inefficient maintenance practices and poor management are brought into sharp relief by high-performance milling machines. The machines reveal that milling practice normally considered acceptable is inadequate for efficient utilization of numerically controlled machines. As a result, milling practice is undergoing improvement.

Some trends tend to eliminate milling, to make it disappear—by closer forgings, by investment castings and so forth. Combining milling with other operations on a machine equipped with an automatic tool changer tends to submerge milling as a separate entity. Conversely, milling is the subject of intense analysis—downtime costs too much to allow inefficiency. Improvement of cutting and workpiece material uniformity is sought to enable consistently higher metal removal rates. Most significant is that high-performance milling machines are demanding high performance of manufacturing engineers.

We Slipped!

In the article "Milling High Strength Alloys" by Norman Zlatin and Robert Krueck (*THE TOOL ENGINEER*, May 1960, p. 123) there is an error in the "Key to Charts." AR = axial rake angle, not "axial relief angle" and RR = radial rake angle, not "radial relief angle." Our apologies to the authors and to any readers who may have been misled by these typographical errors.

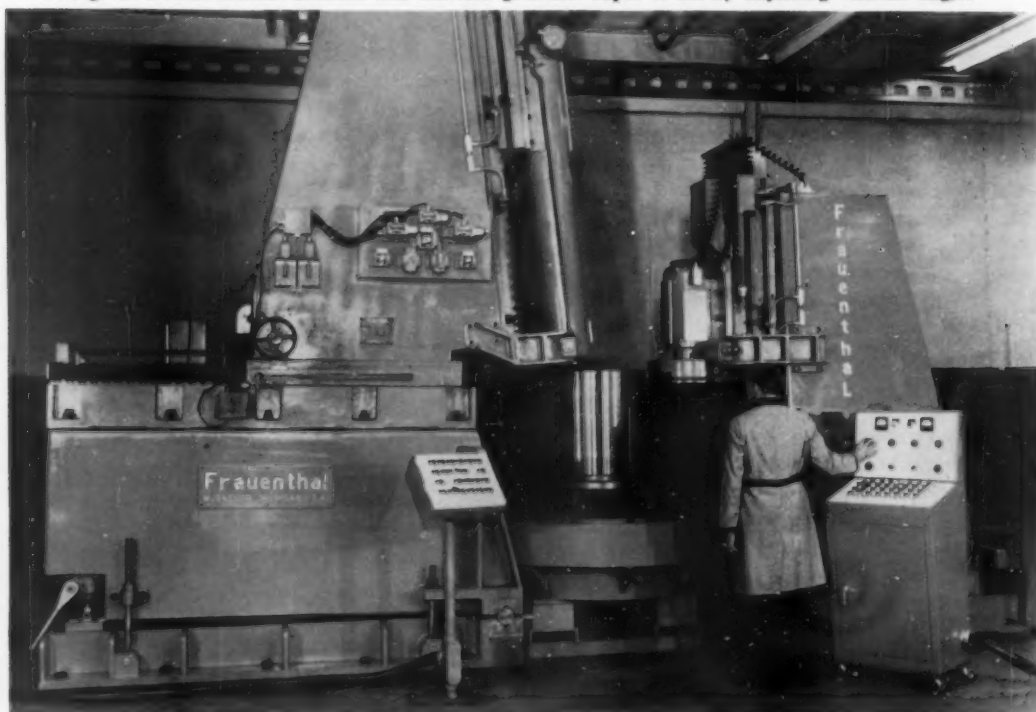
FASTER METAL REMOVAL TO MILLIONTHS

—trends in abrasive machining

Dressers that endure for the production of 6 million parts, lapping methods to obtain better than 1 microinch finishes, accuracies to ± 0.0001 inch, high-production rates, high-metal removal rates—these are among the capabilities offered by abrasive metal removal.

DEVELOPMENTS in the machines, wheels and techniques of abrasive metal removal now place a large array of versatile methods at the disposal of tool and manufacturing engineers. Most of the modern machines and techniques are the culmination of long and careful development work by machine builders and wheel manufacturers. Cumulative improvements over preceding machines now enable grinding to supplant other metal removal methods for many operations. Since its origin grinding has been a finishing operation and this still constitutes a considerable portion of the grinding done today, but

Fig. 1. Double-column internal and external grinder. Taper is set by adjusting column angle.



By Robert Heslen
Associate Editor

wheel, coolant and machine developments make grinding a useful method of high-production metal removal. Grinding is most often the means used in high-precision work also. The scope of this article must be limited to indicate only a few of the many ways that this versatile technique serves to improve manufacturing efficiency and quality.

Accuracy and Finish: As moving parts are subjected to greater loads and velocities and as more automatic assembly machines are used, the tolerance requirements for finish and accuracy are tightened. Typical of the use of grinding techniques to meet such requirements is the double column precision ID and OD grinder in Fig. 1. The machine produces large oil bearings (used in foil rolling mills) that must be highly accurate and have a good finish. Vertical design of the machine was derived from ball race grinders and results in floor space savings, rigidity and minimum cantilever. In operation the taper of the bearing sleeve ID is obtained by setting the column angle as required. Raising the back end of the column moves the column through an angle about the column pivot so that tapers can be varied, or cylinders ground if required. The workpiece is of forged SAE 4640 die steel. Hardness runs from 325 to 375 Bhn, though ends of the workpiece sometimes reach 500 Bhn. The cylindrical OD of the sleeve is the actual bearing surface and rides in a 0.00025-inch oil film. The internal taper, shown being ground in Fig. 2, holds the mill roll. To produce accurate foil the bearing must be produced having highly accurate internal-external geometry. In order to meet these requirements, the piece is rough ground and finish ground on the same machine. After the rough grind, the hold down studs are released to relieve internal stresses before finish grinding. By this means, a 44-inch long sleeve can be held to a 0.0005 or 0.0006-inch total range of variation in wall thickness. Finish obtained is 5 microinches root mean square or better.

Also produced by grinding is another type of bearing, Fig. 3, at the opposite end of the size scale from rolling mill bearings. These bearings range from a maximum 0.625-inch OD to a minimum 0.040-inch bore. Not much metal is removed, but it must be removed with attention to accuracy, finish and economy. Meeting of these requirements for machine output was achieved by specific design of several factors. Geometry and mechanics of machine design contribute toward the objective of accuracy, spindle design helps toward achieving the desired finish and fixturing contributes toward economy of operation. Geometry of the machine is arranged so that both the longitudinal slide for wheel traverse and the cross slide for wheel in-feed are located on the center line of the spindle. Preloaded antifriction ball slides are used to meet the tolerances required by miniature precision work. Design work minimized the thermal drift that occurs when starting up from the cold state. Thermal sta-

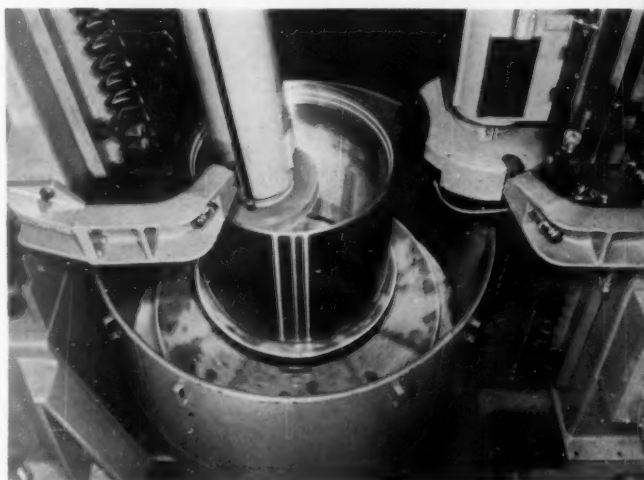


Fig. 2. Tooling for taper grinding of large bearing used in foil mills.



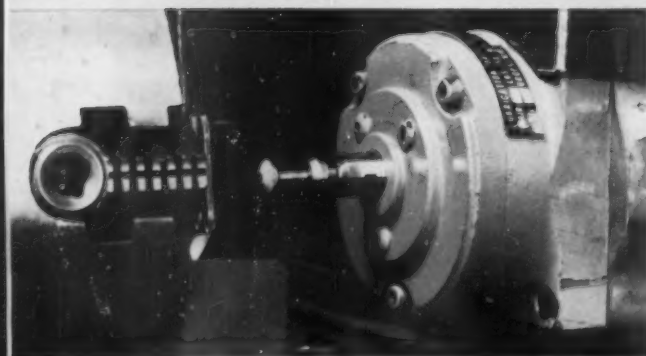
Fig. 3. Precision bearings are produced using small wheels at high spindle speeds.



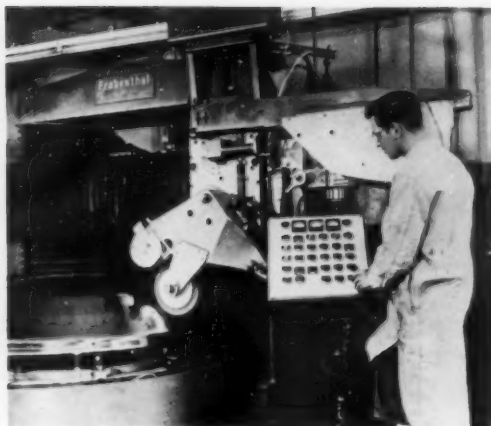
Fig. 4. (above) Miniature bearings are magazine fed, automatically ejected, by this machine.

Fig. 5. (upper right) Tracer-guided double toolhead finishes missile nose cones.

Fig. 6. (below) Setup for internal thread grinding. The $\frac{7}{16}$ -inch diameter wheel operates at 15,000 rpm on this workpiece.



bility aids in maintaining accuracy and also increases daily production by lessening warmup time. The small grinding wheels used are driven by high-speed spindles operating in the range of 60,000 to 150,000 rpm. The wheels are automatically dressed for optimum life. Selective skip dressing is used to suit individual job requirements. Operating economies are gained by the use of automatic workloading and unloading chutes visible in *Fig. 4*. The unground incoming piece nudges the preceding ground piece into the ejection chute. Changeover time from one job to another is minimized by using two fixtures, one in the machine and the other being set up for the next job. The entire fixture can be



removed by rotating a cam screw so that production is almost uninterrupted by changeover.

A somewhat hybrid technique is used for producing the missile nose cone, *Fig. 5*. The workpiece is received from prior manufacturing operations with about 1/16 inch of stock remaining to be removed. For the first operation, the tool head is in the opposite position to that shown in *Fig. 5* and a carbide tool bit is used to turn the workpiece profile under tracer control as a preparation for the grinding and finishing operations. For the second operation the tool head is indexed to the position shown in *Fig. 5*, bringing a Vonnegut polishing head to the nose cone. The brush sections of the polishing head are interleaved with coated abrasive strips. Motor-driven, the rotating head is guided over the nose cone under tracer control to remove a light amount of metal by abrasion. For the high finish required, the final operation uses a rotary lap, swivel-mounted to remain normal to the workpiece surface. A sponge rubber pad is contoured to match the nose cone contour and lined with felt. Suitably charged with diamond paste, a light abrasive lapping cut completes finishing of the piece. Finishes below 1 microinch have been obtained.

For hard materials and highly stressed parts, thread grinders such as the Ex-Cell-O precision internal thread grinder, *Fig. 6* are used when it is impractical or inadequate to use thread rolling, chasing or milling. The process does not tear the thread at the root as cutting tools sometimes do and it thus minimizes fatigue cracks that start from minute surface imperfections. Tolerances obtainable are on the order of 0.0005-inch cumulative error in any foot and ± 0.0002 -inch on pitch diameters. Closer tolerances can be maintained under controlled conditions. The job shown is run at 15,000 rpm using a 7/16-inch diameter wheel. Maximum wheel speed is approximately 45,000 rpm. Production rates vary according to amount of metal re-

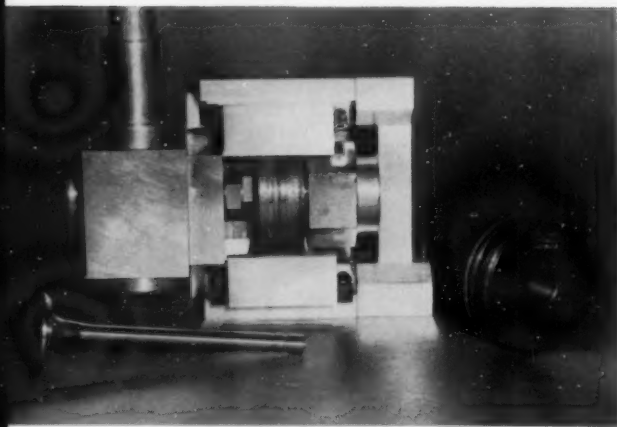


Fig. 7. Fixture for dressing grinding wheels uses a shaped diamond wheel to dress the required form. Finished product, a valve stem, is shown in foreground. Six million were produced by one dresser.

moved and the type of metal being cut. On another typical job—steering gear nuts—rates of 50 to 60 pieces per hour are obtained. Versatility of automatic thread production is part of machine design and workpiece configurations include multiple lead threads, tapers, radius forms and both right and left-hand threads. As accuracy is essential in these types of workpieces, drift from thermal effects is minimized by refrigerating the coolant to a constant temperature after filtering. Water is also used to maintain a constant working temperature within the spindle housing for similar reasons.

High Production: Though generally considered as primarily a finishing operation, grinding is used advantageously for substantial metal removal work. With improved wheels offered by abrasives manufacturers, improved cutting fluids and higher horsepower spindles, relatively high rates of metal removal are achieved. Wheels are selected to break down at a rate sufficient to provide new cutting edges constantly and yet maintain a satisfactory ratio of wheel wear to metal removed. Automatically cycled and compensated dressers are used, sometimes coupled with post-process inspection. By such means the grinding machine achieves a built-in accuracy that is independent of operator skill, which renders feasible the use of automatic loading devices. For high-production work, grinding can often replace other metal removal methods either by producing a given number of pieces with improved accuracy or by providing an increased production rate at some given accuracy.

Such gains are not provided by the machine tool alone. Though it helps make high metal removal rates possible, the improved machine tool also renders the selection of wheels, cutting fluids and cutting conditions more critical. As with carbides and

other cutting tools, higher removal rates enable lower cost production even though tool wear (wheel breakdown) increases. The exact point at which greatest economy occurs requires analysis of the many variables of manufacturing cost. Improvements in grinding machines help make such economies achievable. Production of an automotive steering gear worm screw illustrates some of the possibilities of heavy stock removal by grinding. The blank is first roughed out on a thread grinder using lead compensation to anticipate heat treat shrinkage. Production runs 109 pieces per hour. After heat treat, the worm screws are finish ground at a rate of 50 pieces per hour.

Similarly for high-production work is an Ex-Cell-O groove-grinding machine. By dressing the workpiece contour into the grinding wheel, the grinding wheel abrades the work blank into the part shape ultimately desired. Accuracy and finish of form grinder output is thus dependent on the dressing tool and dressing cycle. Manual inspection is often used to determine the basic frequency of dressing used in high-production machines. Two opposing tendencies must be reconciled—too frequent dressing can interfere with the production cycle and also shorten wheel life, while infrequent dressing can be the cause of poor finish and out-of-tolerance parts, especially toward the end of the dresser's life. General practice is to set the dressing cycle to

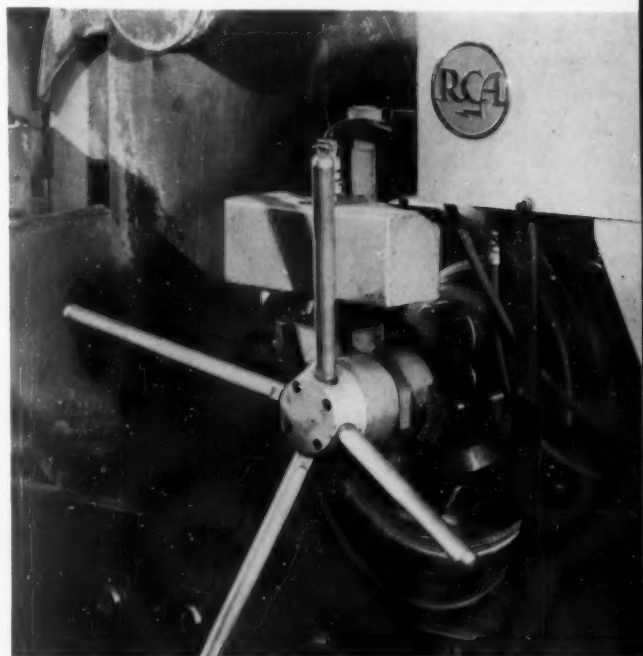


Fig. 8. Electronic bed control gage measures grinder compensation movement each time the grinder output gage detects an out-of-tolerance part and signals for an adjustment to keep output in tolerance.

Fig. 10. (right) Work station of dual-spindle grinder. Inspection head continuously monitors size during grinding.

Fig. 9. Operator loads one station of a dual-station machine while the other station is grinding.

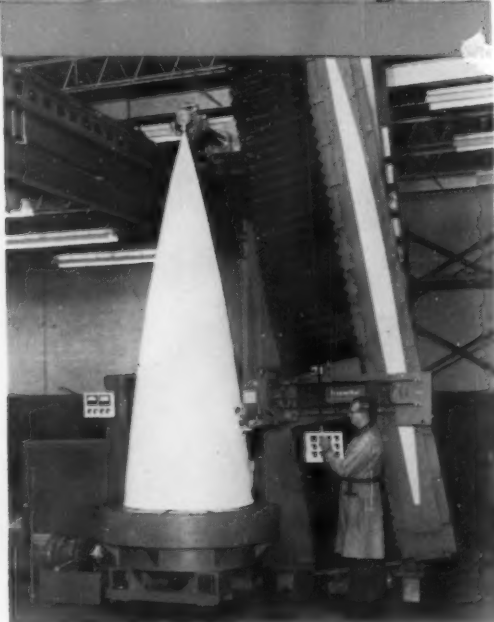
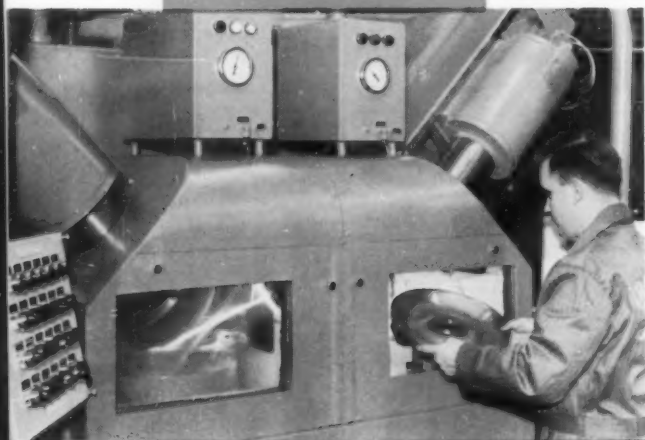


Fig. 11. Vertical radome contour grinding machine.

occur at an optimum number of pieces by observing the point at which grinder output begins to deteriorate and then setting the cycle to occur before the deteriorated output appears. A margin of safety is allowed. Where high accuracy is desired or dressing is critical, automatic inspection, either in-process or post-process, is employed to trigger the dressing cycle.

Whether manual or automatic inspection is used, dresser life influences the productivity of form grinding. Wheel dressers as shown in Fig. 7 have been developed to increase dresser accuracy and life. Grinder productivity is increased in several ways. Scrap is reduced by avoiding the breakdown problems of single-point diamonds. Grinding wheel life is maintained as each dress removes only the amount of abrasive material necessary to expose new cutting edges and maintain the form accurately. The narrow slot geometry problems of single-point dressers are avoided by using the dressing wheel. The dressing wheel shown, a True-Grit wheel made by Wheel Truing Tool Co. lasted for about a year and a half, on a 20-hour day, and accomplished about 200,000 dressings, sufficient for the production of around 6 million of the valves shown. Thus, downtime for dresser change was at a minimum.

In this application the wheel was plunge dressed with a dresser infeed of 0.001-inch, the dresser rotating at 115 rpm and the grinding wheel at 1250 rpm, in opposite directions at the point of contact. The dressing cycle required less than 3.5 seconds and occurred every thirtieth valve. The exhaust valve stem retainer and sealing grooves were plunge ground in 3.5 seconds, including load and eject time. Sequencing of the dressing cycle was timed to not interfere with the normal loading and ejecting cycle of the Cincinnati centerless grinder on which the dresser was mounted. During the dresser

life, finishes of 12 to 18 microinches and a critical 0.010-0.016-inch corner radius were maintained.

Dressing in of a new wheel was accomplished in about five minutes instead of one hour. This characteristic is used by a valve manufacturer to lessen job-to-job changeover time—when a different valve is to be ground, the dresser is changed but not the grinding wheel. The wheel life lost is more than offset by increased production.

Inspection and feeding equipment can be used to improve grinding machine output. Two different grinders of different makes were modified by the addition of RCA post-process gaging, Fig. 8, and feeding equipment. In the over-all operation cylindrical slug magnets are cast, rough-ground, magnetized while cooling after heat treat, and then demagnetized for handling through subsequent production phases. The slugs are finish ground to a predetermined dimension in centerless grinders. As they leave the grinder, the slugs are gaged. An out-of-tolerance slug triggers the bed to in-feed by a selectable increment into a gage mounted on the bed. The amount of bed movement is measured electronically by the bed-mounted gage, which stops bed movement when the increment of compensatory movement is completed. The grinder control is capable of holding tolerances to ± 0.000050 inch, but is set to hold the slugs to ± 0.001 inch which is presently adequate for the slugs. Should tolerances tighten on the slugs, as might be required for automatic assembly, a reserve of accuracy is available. Adding grinder control and automatic feeders has raised production rates from 1500 per hour to over 4000 per hour.

Automatic cycle control contributes to the production efficiency of the dual table grinding machine shown in Fig. 9. The operator loads the workpiece, a transmission part, manually into the fixture and then presses the start button. The automatic sequence begins: close fixture, start table, close coolant guard, advance grinding spindle in rapid traverse, start coolant, stop rapid traverse and start

feed, initiate gage control, stop feed at finish size, dwell, retract grinding spindle in rapid traverse, stop coolant, open coolant guard, stop table and release fixture. Continuous gaging is used for size control and the gage head can be seen in the close-up view, Fig. 10. When the workpiece is ground to size, the gage triggers the slides to stop and spark out. Whenever dressing is required it is initiated by the operator. Automatic compensation is used. Production is around 125 pieces per hour at approximately 80 percent efficiency.

High Precision Contouring: Unusual accuracy problems are encountered in producing radar nose cones of fiberglass. Radar wave refraction caused by the fiberglass is computable for a given wall thickness, but variance in wall thickness would throw off computations. The wall thickness must be held to ± 0.0015 over the full length of the 148 by 48-inch nose cone. To achieve this, the machine shown in Fig. 11 combines several operations. The 13,000-pound Meehanite mandrel is turned and ground on the machine as a sort of permanent fixture. It remains on the machine during manufacture of the nose cone which occurs in four major steps. First, a flat ribbon of fiberglass is wound on the mandrel at 150 fpm. As the slide moves, table rpm is altered to maintain a constant fpm. The mandrel turns at 12 rpm while the 48-inch diameter is being wound and at 100 rpm while the 6-inch (top) diameter is wound. Second, the fiberglass is cured by injecting steam at 275 F, 250 psi through fittings into the mandrel for 10 hours. Third, cold water is pumped into the mandrel to cool the mandrel and nose cone. Fourth, the nose cone is ground to final dimension in two passes, requiring around 8 hours total. The last operation is to trim the cone off the mandrel.

Meeting the wall thickness requirements for such a large piece required several special design considerations in the grinding machine. Many operations are combined on one machine to avoid refix-

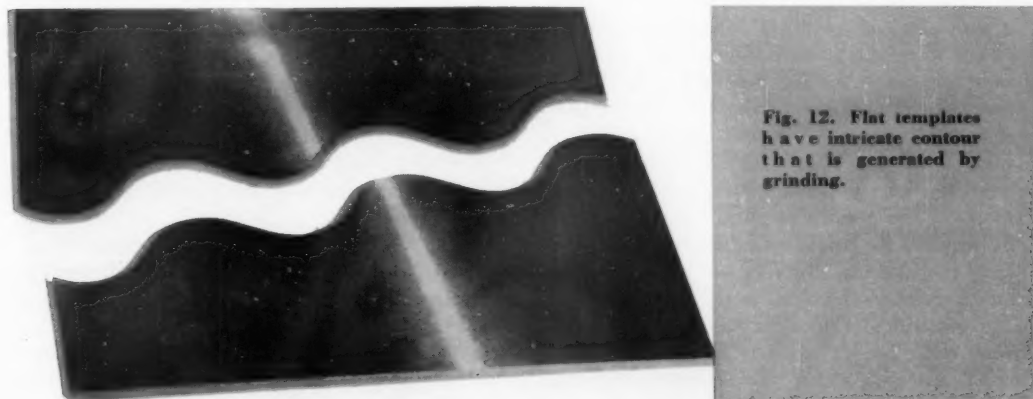


Fig. 12. Flat templates have intricate contour that is generated by grinding.

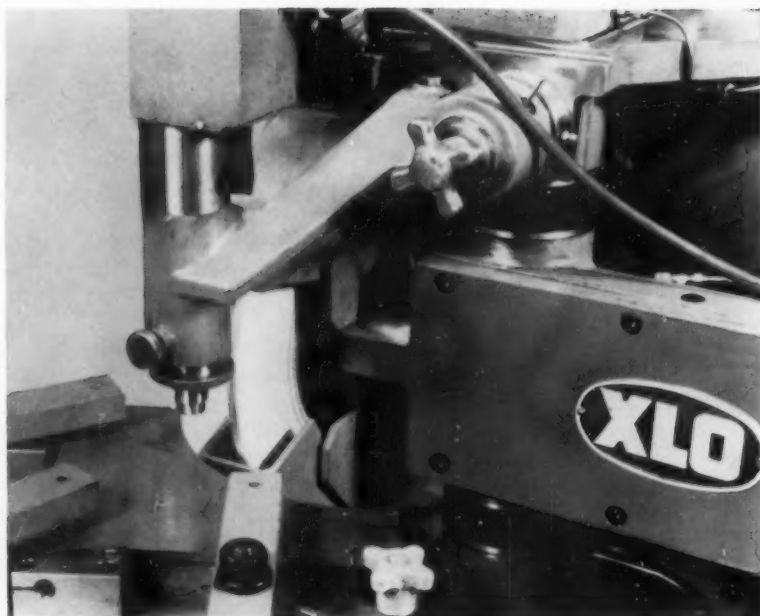


Fig. 13. Built-in precision assists in accurate workpiece location, presented to the reciprocating wheel at an optimum angle.

turing inaccuracies. The fixture itself (mandrel) is generated on the machine. The column is inclined to reduce overhang and gain rigidity and accuracy. In the course of grinding the nose cone profile, the horizontal slide moves both in and out, because of the angle of incline, thus minimizing the need to work at maximum slide excursion. This slide operates on ball races to minimize friction and maintain rigidity. Average table runout is around 0.00015 inch and table flatness is within 0.0005 inch. The template follower is held onto the template by an air cylinder and is adjustable at the follower so that the same template serves for both rough and finish passes. The same method of adjustment at the template follower is used to compensate for wheel diameter removed by dressing.

For producing flat templates such as shown in Fig. 12 to the required accuracy, previous techniques and machine tool designs have evolved to a new level. Operating in a controlled environment, the templates can be made accurate to ± 0.0001 inch and with extra precautions, to ± 0.000070 inch. Partly responsible for this accuracy is the Bendix numerical control system driving the machine. Electronic resolution of the control system is a basic command increment of 0.000025 inch. Equally important is the response of the machine to fine commands. To achieve response, unusual methods were required in design, manufacture and installation of the machine. Rigidity was obtained in all machine members, particularly the base. Precision ball screws with preloaded double bearings are used. Special roller bearings used in the slides minimize friction and give a low static-to-moving friction

ratio. The cross slide, weighing just under 1000 pounds, requires 5.5 pounds of force to overcome breakaway friction and 5 pounds force to maintain steady movement. To protect machine accuracy from thermal hysteresis effects, it was shipped to the installation site in a temperature-controlled van. Rigidity, accuracy and favorable friction ratio all contribute to fine command response.

Part processing is relatively straightforward and the high part accuracy possible with the system is available to the tool and manufacturing engineer without requiring unusual effort on his or the operator's part. The template is presented to the grinding wheel rotated through some angle, as shown in Fig. 13, but the template is drawn and dimensioned in a normal fashion, that is, not rotated. Part of the computer program rotates and translates the template as indicated by the part planner. The wheel reciprocates automatically to produce a flat cut. To minimize the operator's burden in achieving desired workpiece accuracies, the corners used for locating the workpiece are established accurately with reference to the origin of the machine axes. Wheel dressing is initiated either by the operator or the tape in increments ranging from 0.0022 inch to 0.0002 inch. Compensation for dressing is automatic and specially designed to preserve high part accuracy.

Little escapes the capabilities of abrasive metal removal—the method recommends itself to tool and manufacturing engineers for precision work, for obtaining finishes less than 1 microinch, for high-production work, for combining with other manufacturing operations and for high removal rates.

MORE PUNCH FEWER PROBLEMS

... the new look in press design pays off

By Daniel B. Dallas
Assistant Editor

Built-in capacity for fast die changes, protection against overloads and ingenious tooling have made modern press-working highly productive.

VERSATILITY, reliability, higher output and maximum safety—these are the goals of today's press designers. And many of these designers, by taking a fresh look at problems that have plagued the stamping industry for years, have developed workable solutions that are giving a big lift to stamping productivity in this country. Sliding bolster plates on some new presses make it possible to change dies in a hurry. Improved slide positioners also decrease setup time. New tonnage-limiting devices, and variable-speed slides and drives, contribute importantly to press safety and press versatility. Modular design allows press capacity to be increased by simply adding building blocks, *Fig. 1*. In addition, mechanical and hydraulic attachments that convert any conventional press into a shuttle press have brought the benefits of low-cost automation to the stamping industry.

Die Loading: Presses utilizing the sliding bolster design, *Fig. 2*, effectively reduce the time and labor requirements necessary for changing from one line of stampings to another. In many stamping plants, particularly those of the automotive industry, changing from one series of

panels to another requires the setting of as many as twelve dies. Setting a heavy die by conventional methods requires overhead cranes, pry bars, rollers and an unnecessary expenditure of physical push-and-pull. Setting the same die with the aid of a sliding bolster requires only that the die be placed on the exterior bolster. An electrical switch then moves it into the die area, simultaneously removing the other die. In many cases, this operation and subsequent clamping can be completed in as little as seven minutes.

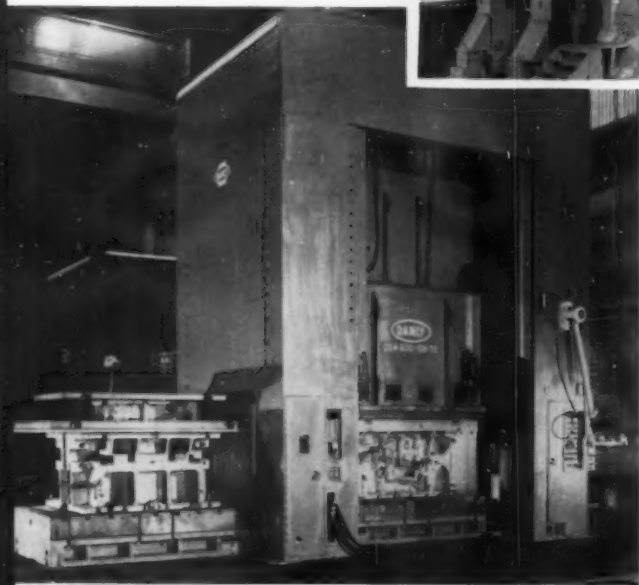
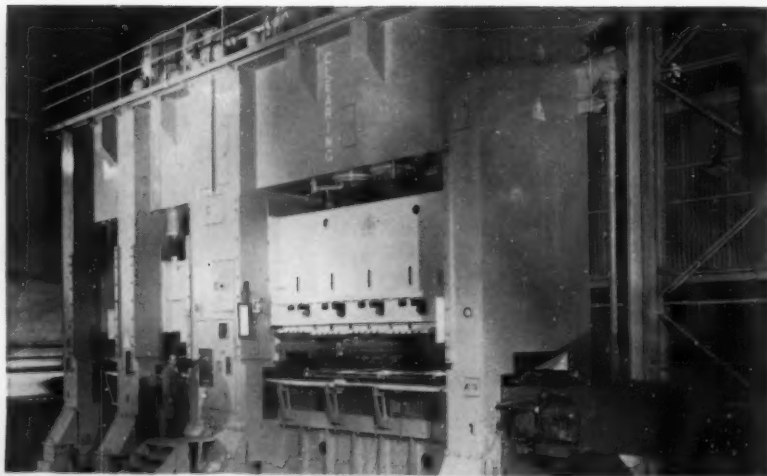
Because die changes by conventional methods often take a complete eight-hour shift, production-control departments usually specify long production runs from any given line setup. While this practice minimizes the number of setups, it creates another problem—that of inventory storage and control. Running an abnormally large stock of parts requires storage space which can be used more effectively for other purposes.

Utilization of the sliding bolster minimizes the problem of inventory storage by reducing die setup time. When an entire press line can be changed from one panel to another in a matter of minutes, inventories can be reduced to levels sufficient for current production needs.

The end results of this development are increased production through lowered setup time, and increased flexibility in the press line. Sliding bolsters also provide tool engineers with fewer restrictions when designing material-handling equipment. Older presses require comparatively light automation equipment which can be removed during die change-over. Quick-change dies open the way to heavier, semipermanent material-handling equipment.

Fig. 1. (right) Building-block technique utilized in press manufacture. Addition of standard units (at left) provides required length for shuttle operation.

Fig. 2. (below) Quick-change press. At completion of production run, bolster moves on tracks to change dies.



Slide Design: Changes in slide design and operation work effectively in conjunction with the sliding bolster to reduce die setup time. One significant development is the Dancy automatic slide positioner. This device enables setup men to dial shut height to within 0.005 inch. Basically, the positioner consists of a standard cascade type reversing automatic motor starter, a resistance bridge and two polar-sensitive amplifying units which control direction and amount of adjustment.

Improved overload devices incorporated into modern slide designs are doing much to reduce press downtime caused by overloading. (The great majority of mechanical failures in stamping presses can be attributed to overloading.) Because complicated stampings normally require multiple die operations, a mechanical failure in one press will put the entire line out of action. For this reason component failures in presses used in line operations are considered line failures. The economic consequences of line failures has forced the devel-

opment of better, more effective press overload devices.

Several good solutions to this problem lie in the field of die design. For example, if a die is to be run in a press equipped with a quick-stop clutch, spring-loaded pilots can be used to actuate micro-switches which stop the press instantly. Other die designs include limit switches which stop the press cycle in the event a panel is not stripped from a punch. However, these safety devices do not lend themselves to all types of die and press design, so the ultimate safeguard against overloading should be in the press itself.

Press manufacturers in the past have utilized shear collars mounted in the suspension point adjusting screws as tonnage-limiting devices. While these are effective within a limited range of applications, they do not afford the die and press protection required in modern industry. They are effective only at the bottom half-inch of stroke. They protect the press only, and cannot be adjusted to possible lighter tonnage limitations in the dies. Also, through repeated strain resulting from near-maximum tonnages, shear collars occasionally shear under less-than-rated loads. Once sheared, they must be replaced before press operations can be renewed.

Because of this inflexibility and general inefficiency, the major press manufacturers have developed a number of tonnage-limiting devices that control either the slide or the clutch. Clearing, for example, uses a hydraulic piston in the slide adjusting screw. An air-hydraulic intensifier maintains the hydraulic pressure and an air-operated hydraulic pump maintains volume. When the slide meets resistance in excess of a preselected tonnage, the intensifier piston is forced down and a limit switch is tripped. This action immediately stops the motor, preventing any damage to press or die.

Bliss Co. is utilizing a pneumatic device which prevents overloading by maintaining a relatively constant torque throughout the press cycle. In operation a pattern of air pressures, predetermined by the crank position, is established at the clutch. As the crank rotates, air pressure to the chuck falls and rises, reaching a maximum at the start of a cycle and a minimum at 180 deg. In this way maximum and minimum air pressures coincide with maximum and minimum torque requirements. Electrical connections are arranged so that maximum air pressure is maintained throughout the entire cycle when the press is jogged.

Variable-Speed Slides: Built-in protection against overloading is provided by hydraulic pistons in twin-power presses. This type combines the principles of hydraulic and mechanical power. Although hydraulic and mechanical presses are non-competitive in their applications, a hybrid combination of the two has enlarged the scope of metal-drawing operations.

As illustrated in Fig. 3, the time-motion curve for a mechanical press is steep throughout its cycle, maximum velocity being attained at the beginning of the draw. By comparison, the slide velocity of a twin-power (mechanical-hydraulic) press is zero at midstroke with a consequently lower initial draw speed. The slope of the curve at the beginning of the draw is critical because plastic flow is initiated at this point. When the flow has started, slide velocity can be safely increased. Cycle completion after the draw is extremely low as shown by the steepness of the return curve.

The third time-and-motion curve illustrated in Fig. 3 is obtained from a twin-power press geared for lower speed. Cycle time of three seconds is identical to that of the mechanical press, but the duration of the draw is much longer, as shown by its comparatively shallow curve. Such a curve is ideal for the "impossible" draws but inefficient for routine drawing operations. For this reason, a number of flywheel sizes and gear ratios are available in twin-power presses.

Variable-Speed Drives: Because twin-power drives are not applicable or desirable in all presses, industry is making increased use of variable-speed motors. Their function quite simply is to provide presses with greater versatility through variations in their slide speeds. By enabling operators to change slide velocities, variable-speed motors can increase the flexibility of the entire stamping plant. High-speed blanking or low-speed drawing operations need not be confined to specified presses.

In line operations this has far-reaching effects: no matter how long the sequence of operations, slide speeds can be adjusted to the specific requirements of the dies being run. Because a press line

can function only as fast as its slowest press, variable-speed drives have effectively removed a traditional obstacle to efficient press line operations.

Variable-speed drives have an ideal application in twin-power presses. Their use enables the press whose curve is shown in Fig. 3b to produce the shallow curve at 3c. When drawing operations are extremely difficult, even slower slide speeds are not impossible. Variable-speed drives in combination with variable-speed slides may well show the way to new design possibilities in the engineering of drawn panels.

Although variable-speed press drives have attained a high state of development, their application is somewhat inhibited by the still-incomplete development of material-handling systems. This area of the pressworking industry, more than any other, shows the need for continued research. When the problems of part positioning and material flow

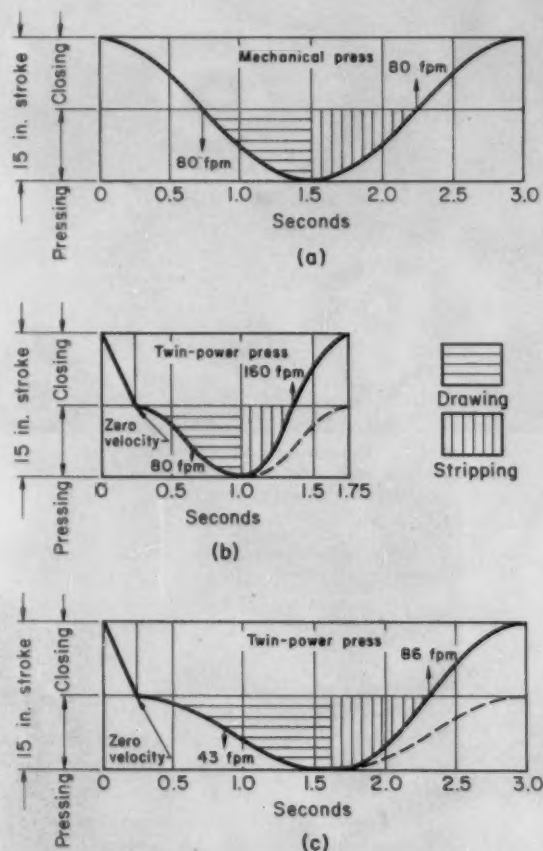


Fig. 3. Upper curve shows slide action of a mechanical press. Center and lower curves represent slide movement of twin-power (mechanical-hydraulic) presses.

have been solved, presses can be run "open" with their speeds geared to those of the handlers. This will not only increase press efficiency—it will contribute greatly to machine longevity.

Press Automation: The ability to move panels in an uninterrupted flow from press to press with no interruption of individual press cycles is still in the development stage. However, it has been attained within individual presses by shuttle devices. This is seen in *Fig. 1* in which the press utilizes a shuttle mechanism to move parts from die to die.

An obvious parallel to this operation is found in the progressive die technique, although the shuttle press provides a flexibility unobtainable in conventional progressive operations. For example, advancing panels can be tilted and pierced or wiped or drawn completely around the edges. In short, all conventional progressive-die operations can be

from using the unit in a press of longer stroke, although an increase in dwell period results.

A similar unit utilizes air or hydraulic cylinders to actuate the shuttle, *Fig. 4*. This unit is designed for high-speed presses and presses with extremely short stroke. On high-speed presses, a mechanical linkage causes an excessively fast shuttle motion. On short-stroke presses, there is insufficient slide motion remaining after punch withdrawal to actuate a shuttle.

There are no unusual problems involved in converting transfer units from one set of dies to another. In some cases special fingers designed to conform to part contours are required. The transfer dies used must, of course, be built to the progression (distance of shuttle travel) of the unit. In most cases these dies are built according to established progressive-die techniques.

Press Safety: Any discussion of automation in pressworking leads inevitably to problems of operator safety. An old pressroom maxim—often remembered more in the breach than the observance—is that no part of the operator's body must enter the die area. In conventional press operations, the operator's hands can be effectively "tied" at the run switches. However, this safety device presupposes an intermittent cycling of the press. When slide motion is continuous, other operator safeguards are necessary.

One interesting development for this purpose uses radio antennas mounted on the slide and bolster. If operators move too close to the working area, the antennas relay signals which are used to stop the press. Another, quite similar, press-stopping device utilizes radioactive signals to stop slide motion. In this case signals emanate from mildly radioactive bracelets worn by the operators.

Increased safety to both operator and press is probably the most significant aspect of modern pressworking. The relatively low-production pressrooms of a generation ago were poor worker-insurance risks and generally represented the most casualty-ridden areas in industry. Today's high-production stamping plants, while moving rapidly toward total automation, are as safe—or safer—than the assembly lines they feed.

References

1. Russell, Royal E.—"A Look to the Future in Stamping Plant Equipment," Paper No. A-5923, presented at the 23rd Annual Machine Tool Electrification Forum, Buffalo, N. Y., 1959.
2. Berry, W. D.—"The Modern Stamping Press," Paper No. A-6016, presented at the 24th Annual Machine Tool Electrification Forum, Pittsburgh, Pa., 1960.
3. Ladd, J. F. and N. Onjanow—"Press Drives in the Automotive Industry," Paper No. A-6019, presented at the 24th Annual Machine Tool Electrification Forum, Pittsburgh, Pa., 1960.

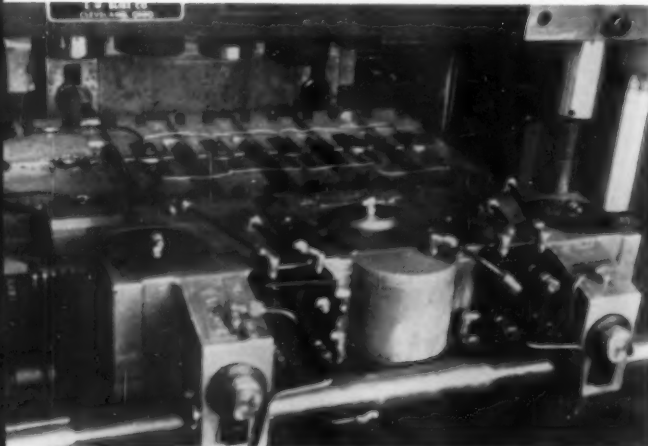


Fig. 4. Air-actuated shuttle unit. This mechanism enables any press of sufficient size and stroke to function as a transfer press.

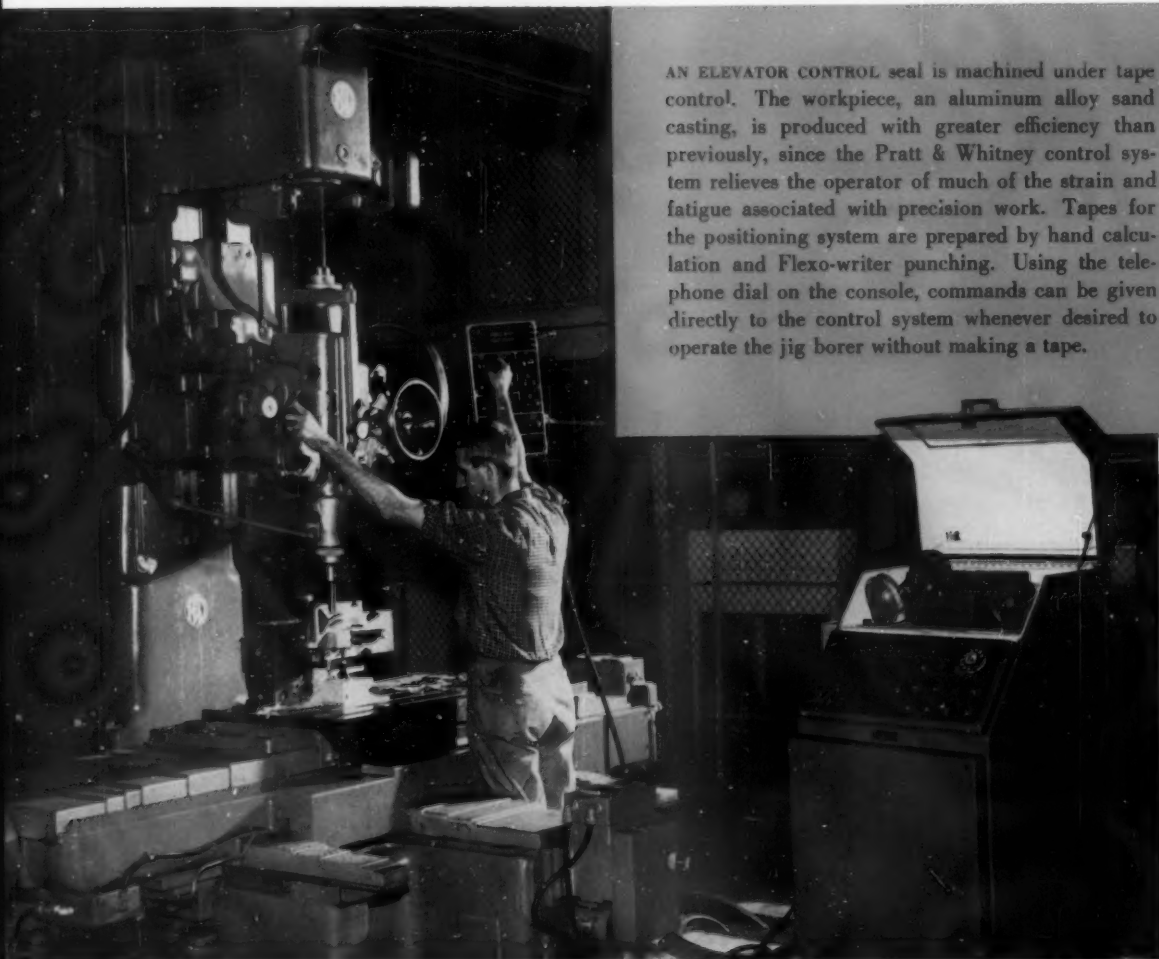
accomplished—and more—on shuttle presses. Progressive dies restrict normal press operation to the extent by which the strip carrier interferes with those operations. This interference is entirely eliminated in shuttle presses.

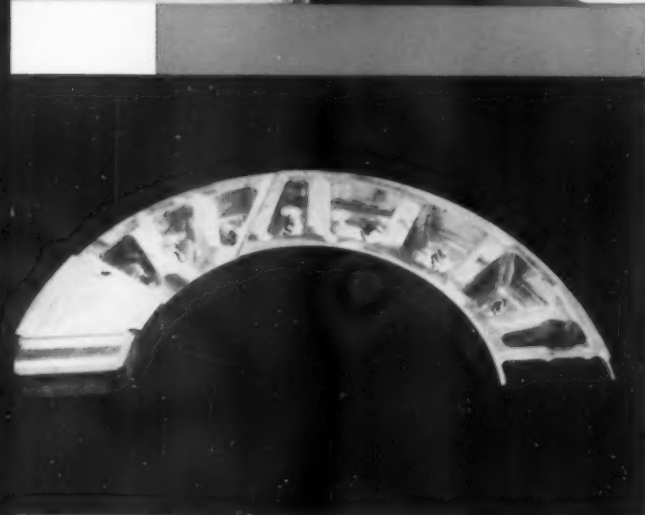
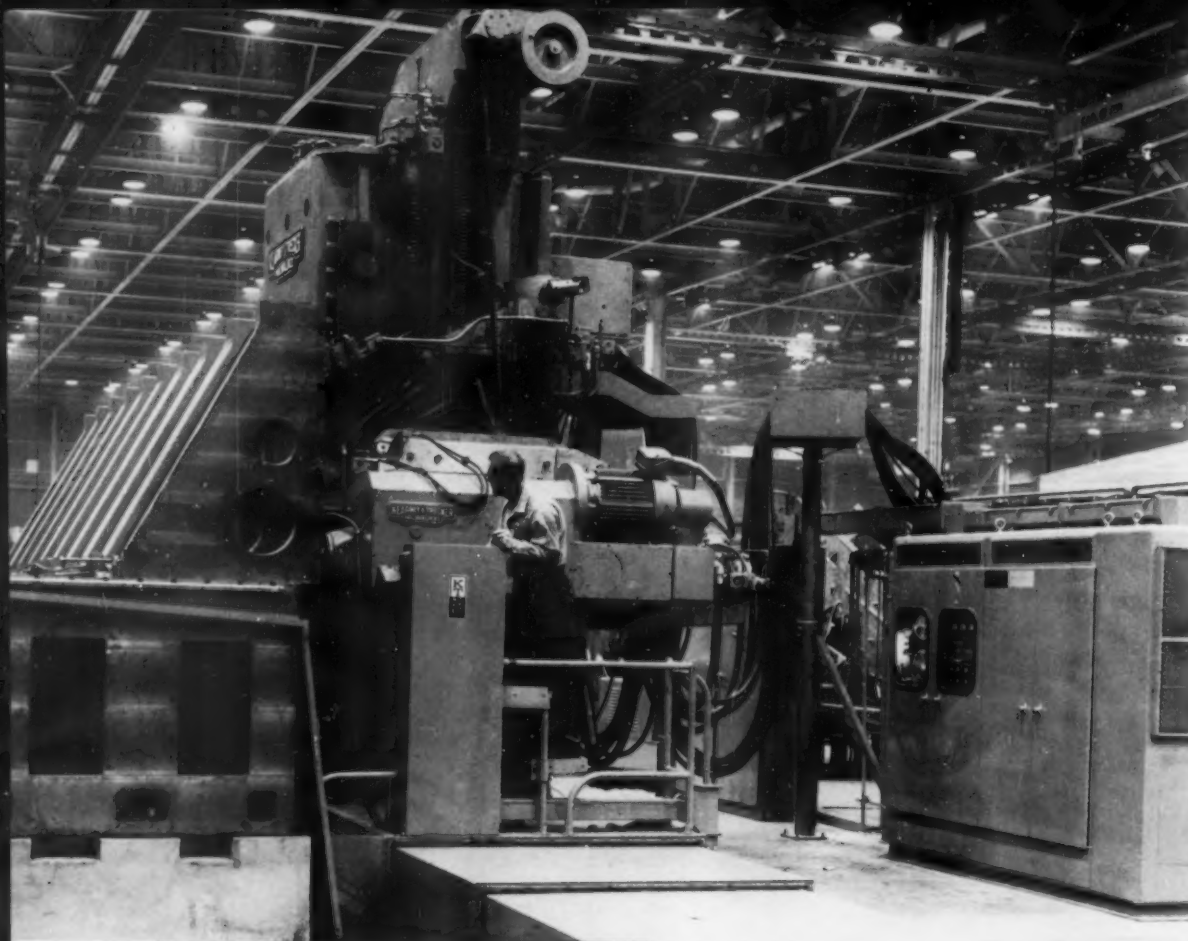
Although the press illustrated is designed specifically for this purpose, a conventional press can be converted into a shuttle press by a transfer mechanism. A Livernois Engineering Co. unit utilizes the stroke of the slide to actuate the shuttle. This movement causes the fingers at each station to grasp their respective parts and advance them to the next die. Because these units are engineered for strokes of certain length, they cannot be used in shorter-stroke presses. No adverse effects result

TOOLS at work

Tools can be made to work more efficiently under control of numbers than under direct control of operators according to the experience of North American Aviation. Three of Columbus Div.'s machine tools are shown here. All three operate under numerical control, following the instructions provided by NAA's tool engineers. Both computer programs and hand calculators are used to prepare machining instructions. Production records on a selected batch of parts reveal that the workpieces are now produced in one-third the time required by conventional methods.

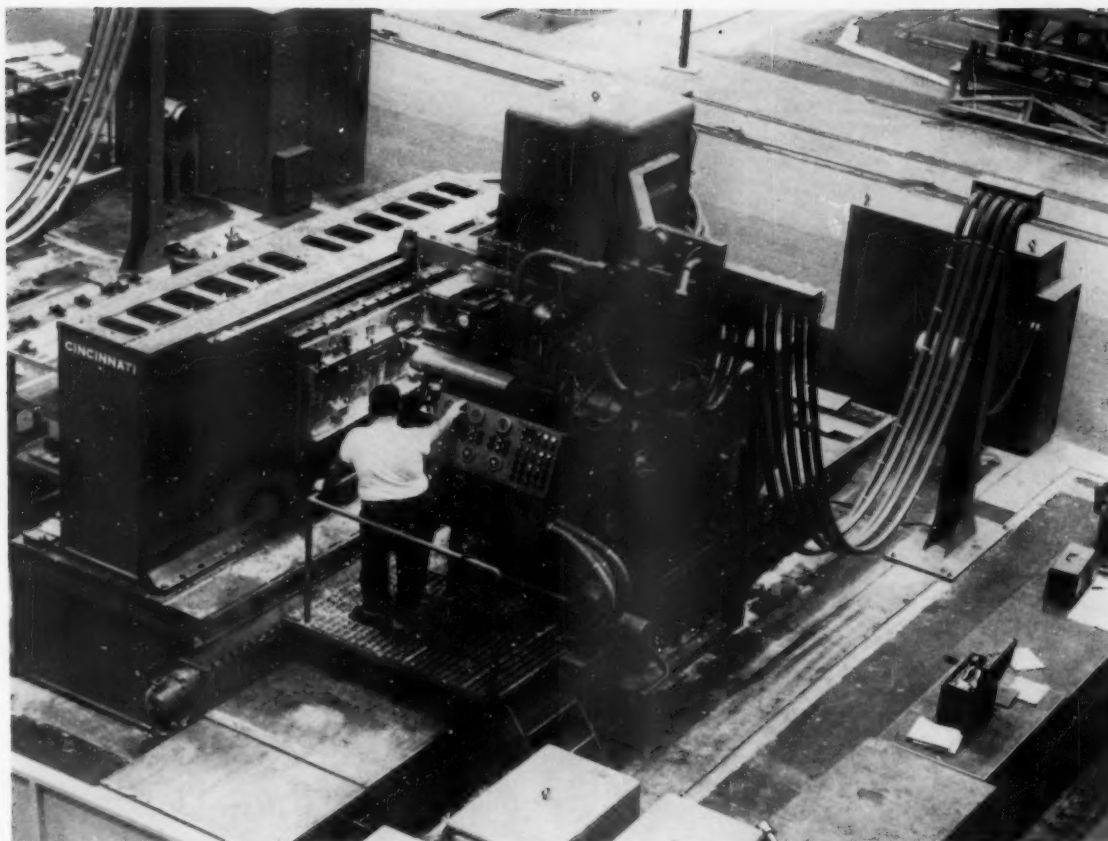
AN ELEVATOR CONTROL seal is machined under tape control. The workpiece, an aluminum alloy sand casting, is produced with greater efficiency than previously, since the Pratt & Whitney control system relieves the operator of much of the strain and fatigue associated with precision work. Tapes for the positioning system are prepared by hand calculation and Flexo-writer punching. Using the telephone dial on the console, commands can be given directly to the control system whenever desired to operate the jig borer without making a tape.



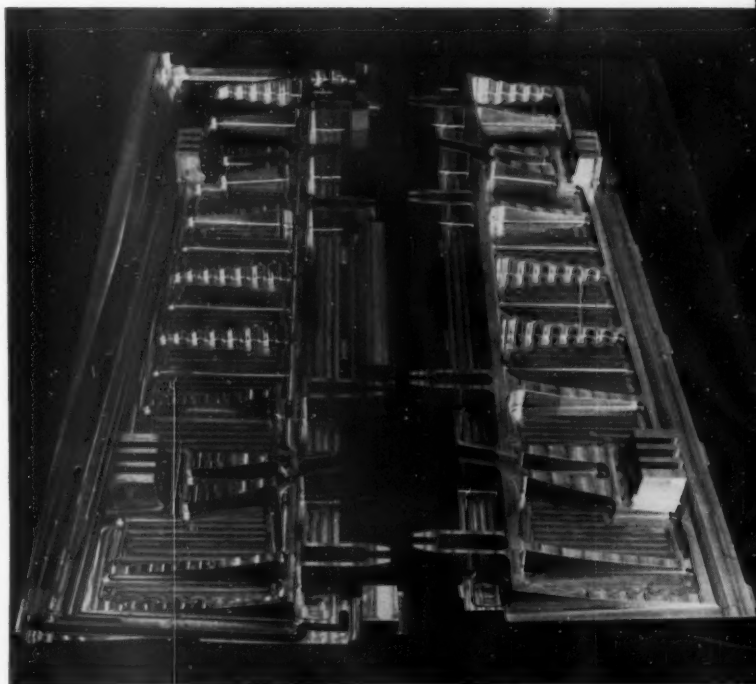


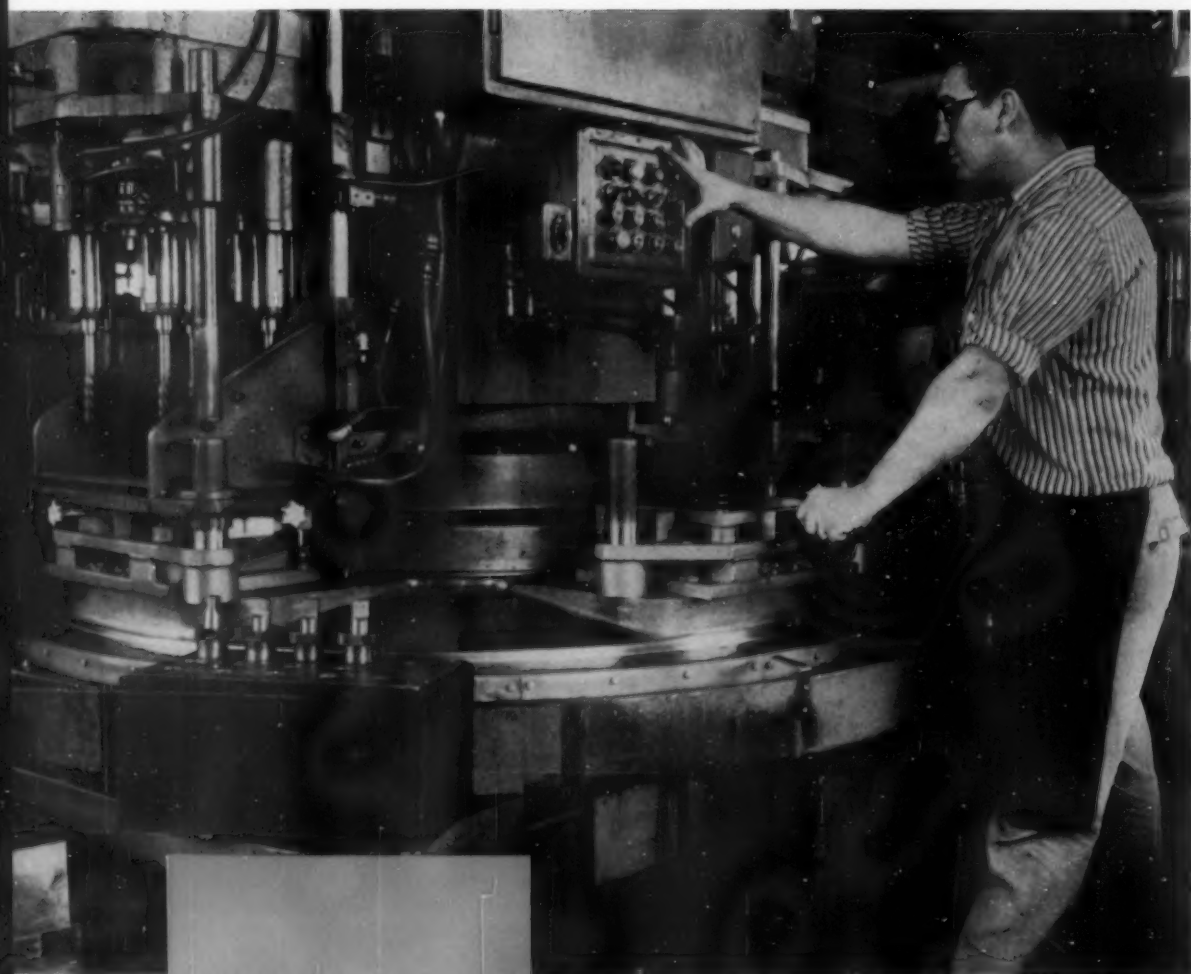
EIGHT UNDERCUT POCKETS and a slotted splice plate make machining of this ring segment complex. The workpiece, a hand forging of 7079T6 aluminum alloy was machined in 5½ hours under numerical control instead of an estimated 80 hours that would be required by conventional methods. Design changes made the right-most pocket keyhole shaped for manufacturing convenience, to allow entry of the T-slot type cutter into the undercut pocket. The machine is a four-axis Kearney and Trecker profiler operating under control of a Bendix punched tape system, at the right. The fourth axis, tilt, was not required for the machining of this piece, but is reserved for swarfed pieces.

TOOLS at work



MACHINING A DEFLECTOR from the original hand forging in 7079T6 aluminum alloy requires sculping away much of the original metal in three-dimensional cutter paths to leave the workpiece as shown. Both left-hand and right-hand parts are made from the same punched cards, using a mirror-image switch control. Hand calculating, using regular and square-root calculators is used in preparing data to punch the cards that serve as input to the system. The Cincinnati miller is controlled by a Cincinnati card-reading system.





HOLES IN PLATES for mold bases are drilled on a special multi-station machine at Detroit Mold Engineering Co. Work material is steel as hard as 300 Bhn. Versatile fixturing makes it possible to drill holes in plates of various sizes. Thicknesses range from $\frac{7}{8}$ to $5\frac{7}{8}$ inches. Speedicut chipbreaker drills have replaced standard twist drills for this operation. The chip breaker drills make it possible to drill through the thick plates in one pass. Previously, it was necessary to withdraw the drill six to eight times on $\frac{7}{8}$ -inch plates, up to 20 times on $5\frac{7}{8}$ -inch plates. The original drilling cycle time of six minutes has been reduced to less than three minutes. Hole diameters are from $2\frac{7}{64}$ to $1\frac{1}{4}$ inches. Spindle speed is 160 rpm. Feed is 0.0007-0.010 ipr. Tool life averages 35 holes per grind.

TOOLS at work

adventure in

Productivity

—an advance look at the
MACHINE TOOL EXPOSITION

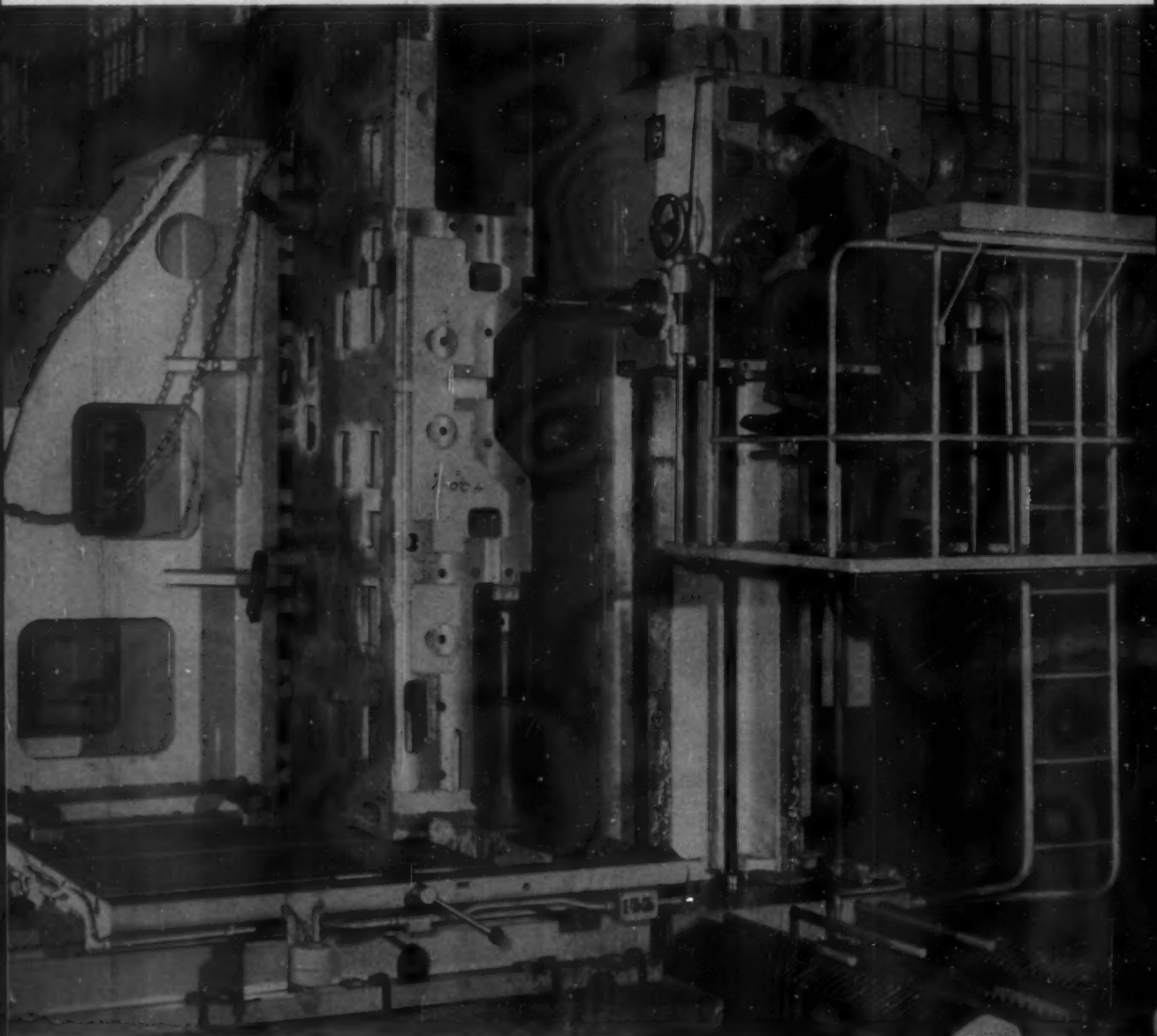


These machines, representative of the hundreds that will be exhibited at the 1960 Machine Tool Exposition, Sept. 6-16, illustrate the tremendous advances that have been made in machine design and performance during the past five years.

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boring

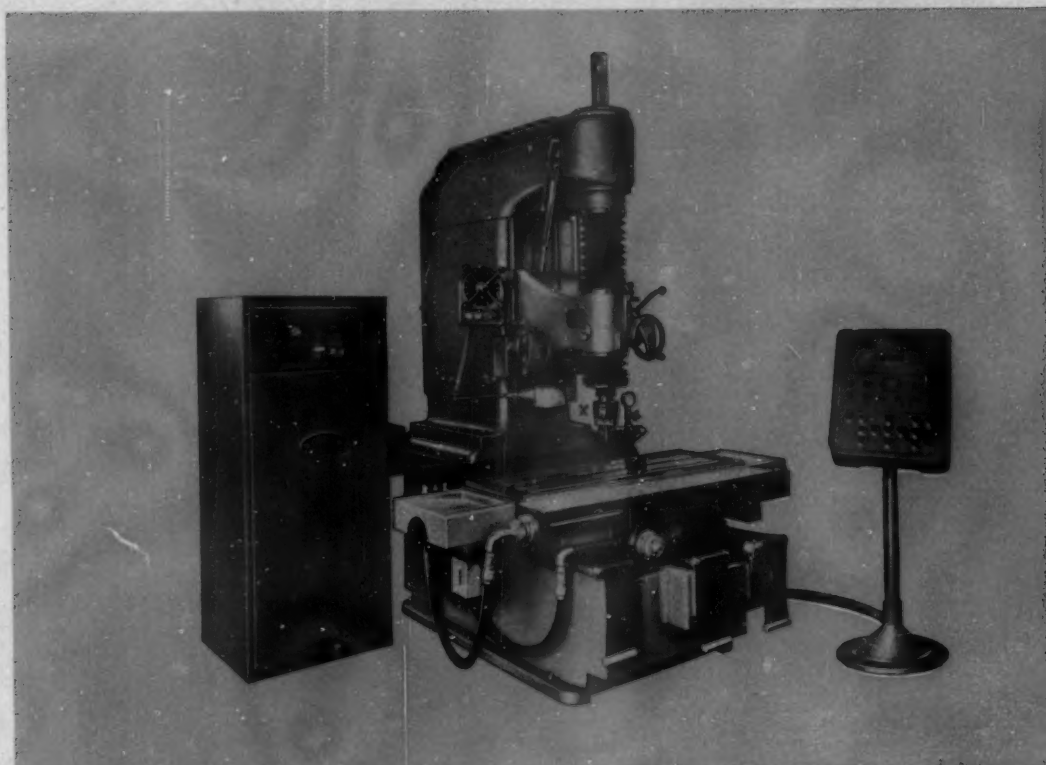
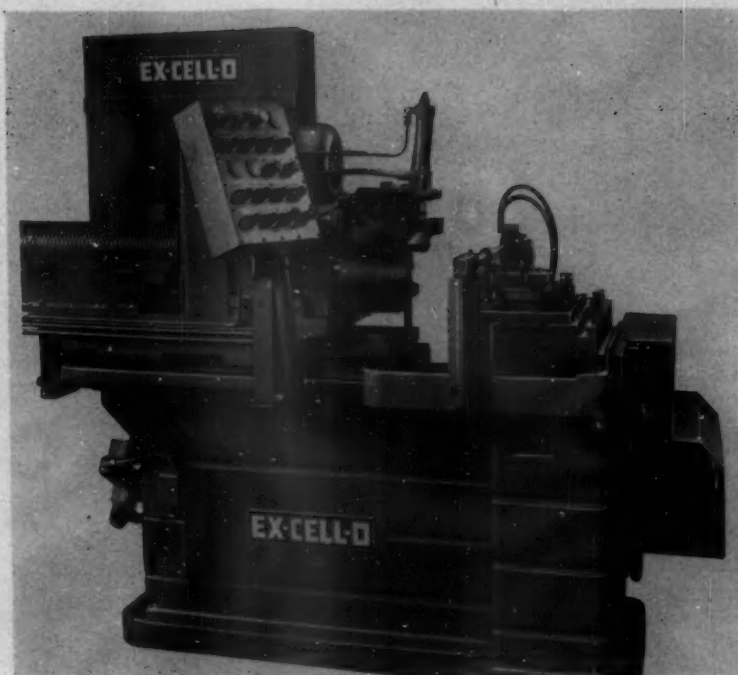
Many of today's large boring machines are actually combination machines, capable of drilling, tapping, milling and related operations. On both large and small machines, higher horsepower and numerical control have boosted productivity by factors of three or more.



This Giddings & Lewis No. 3045 tape-controlled 5-inch floor type horizontal machine with auxiliary table is capable of drilling, milling, tapping and precision hole-to-hole boring operations. The 25-hp machine has digital dial control for preselection of the

head and column position; preselection of feeds and speeds; a 5-inch spindle with 42 inches of travel; depth control of spindle; and a power drawbolt for faster tool changing. Vertical head travel is 8 ft and the horizontal column travel on a runway is 10 ft.

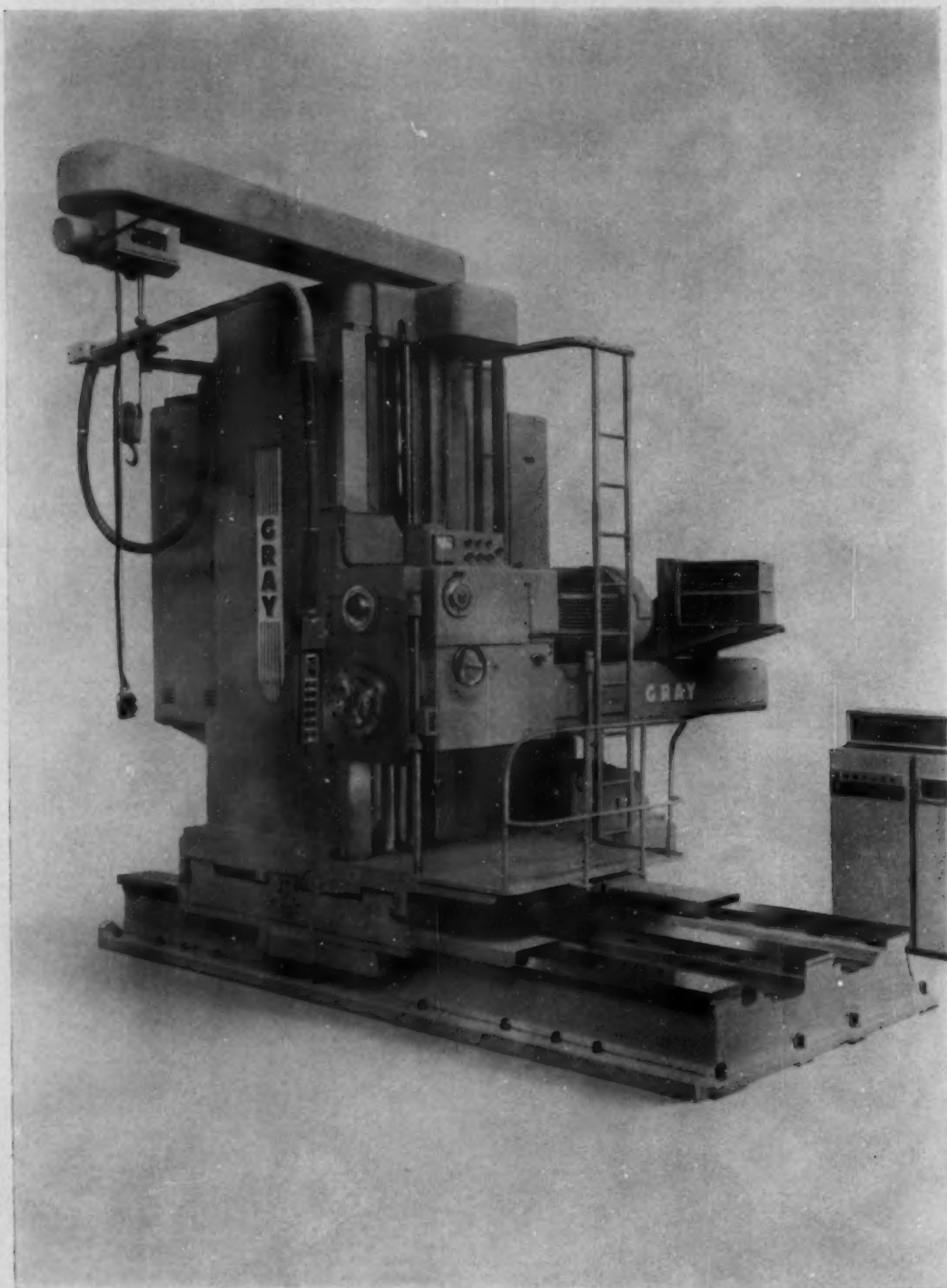
Utilizing direct cam action on both table and cross slide, Ex-Cell-O's No. 308 cam boring machine is capable of performing precision contouring, boring, turning, facing and grooving operations, either singly or in various combinations, to close tolerances. Both table and cross slide cams are mounted on a single shaft, which swings out of the base for fast cam changing. The machine can be equipped to produce small parts from bar stock.



Positioning accuracy is obtained from precision linear transducers on this Knight No. 65 numerically controlled jig borer. Electric signals give the location of the slides without physical contact. The table and saddle traverse simultaneously to reach each position in

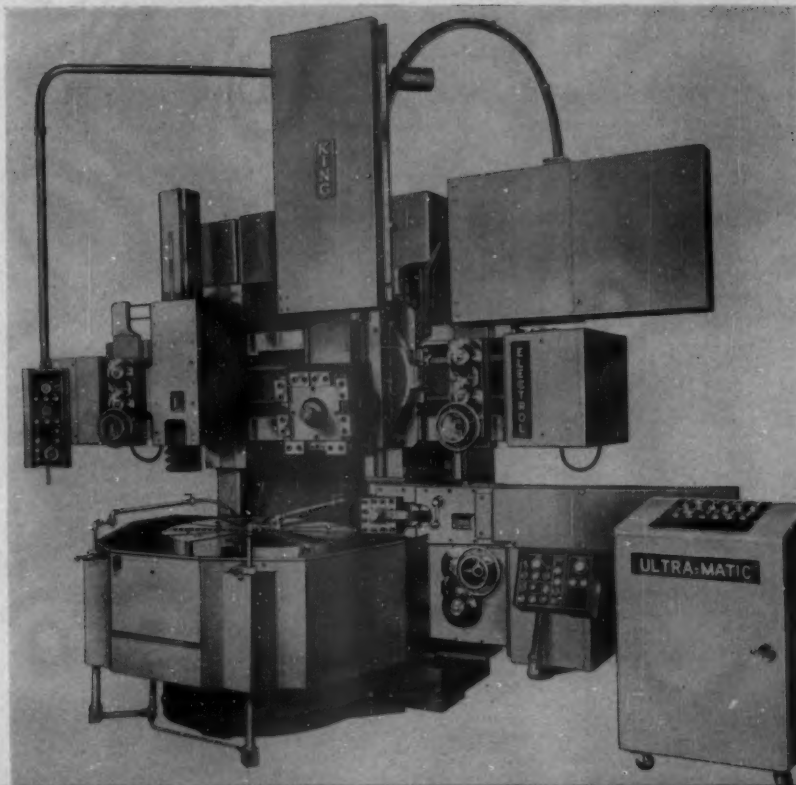
the shortest possible time. The machine is equipped for both tape and manual dial input, with pushbuttons for the rapid traverse. It has an 18 x 52-inch table, 28-inch longitudinal movement, 18-inch cross movement and a 27½-inch vertical capacity.

boring



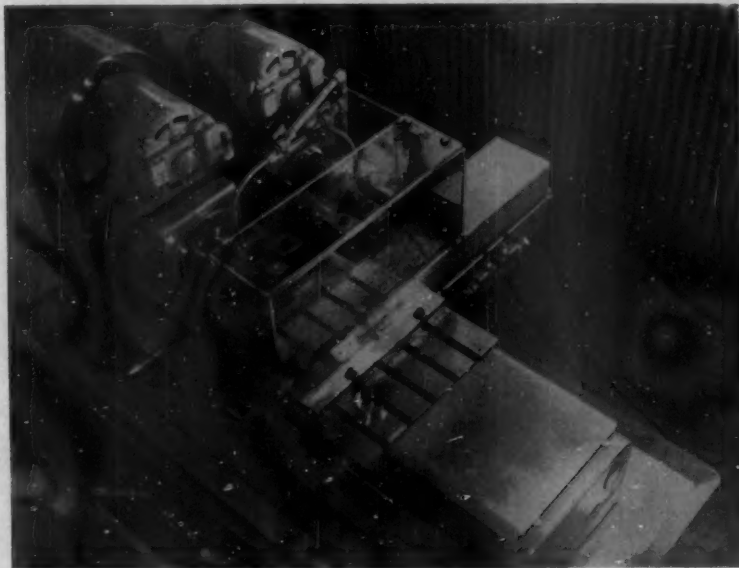
This Gray No. 660 FC horizontal boring, drilling and milling machine has a self-contained jib crane, making the operator independent of other shop facilities

for tool changes. The column and head can be set to within 0.00025 inch. Coordinates are dialed. The machine can be equipped with numerical control.



The programming device on this 46-inch vertical boring and turning machine permits complete automatic control of a full cycle of machining operations, including feed selection and change, speed selection and change, head movements, turret indexes and coolant pump on and off. An electronic tracer on the ram head allows 2-dimensional 360-deg tracing

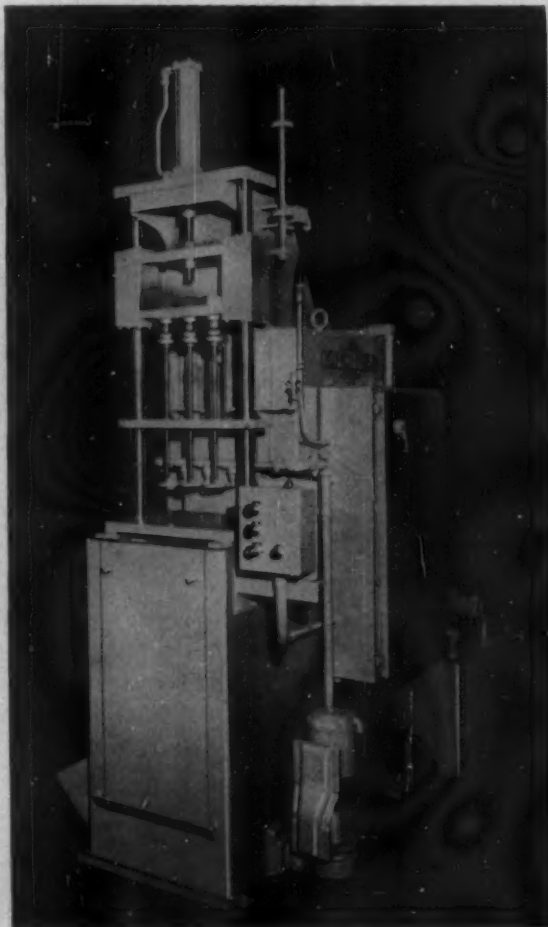
operation. Because the machine has constant chip thickness control interlocked with the constant surface cutting control of the table, the movement of the tool slide across the workpiece maintains both constant surface cutting and the preset feed rate for all changes of the table. The machine can be operated manually. King Div., American Steel Foundries.



This boring machine provides single or double-spindle setups for close precision turning, boring or facing operations. Produced by Jones & Lamson Machine Co., it is capable of completely machining both inside and outside surfaces of stainless-steel cups in a single 20-sec cycle.

broaching

Versatility and power—these are the trends in broaching today.



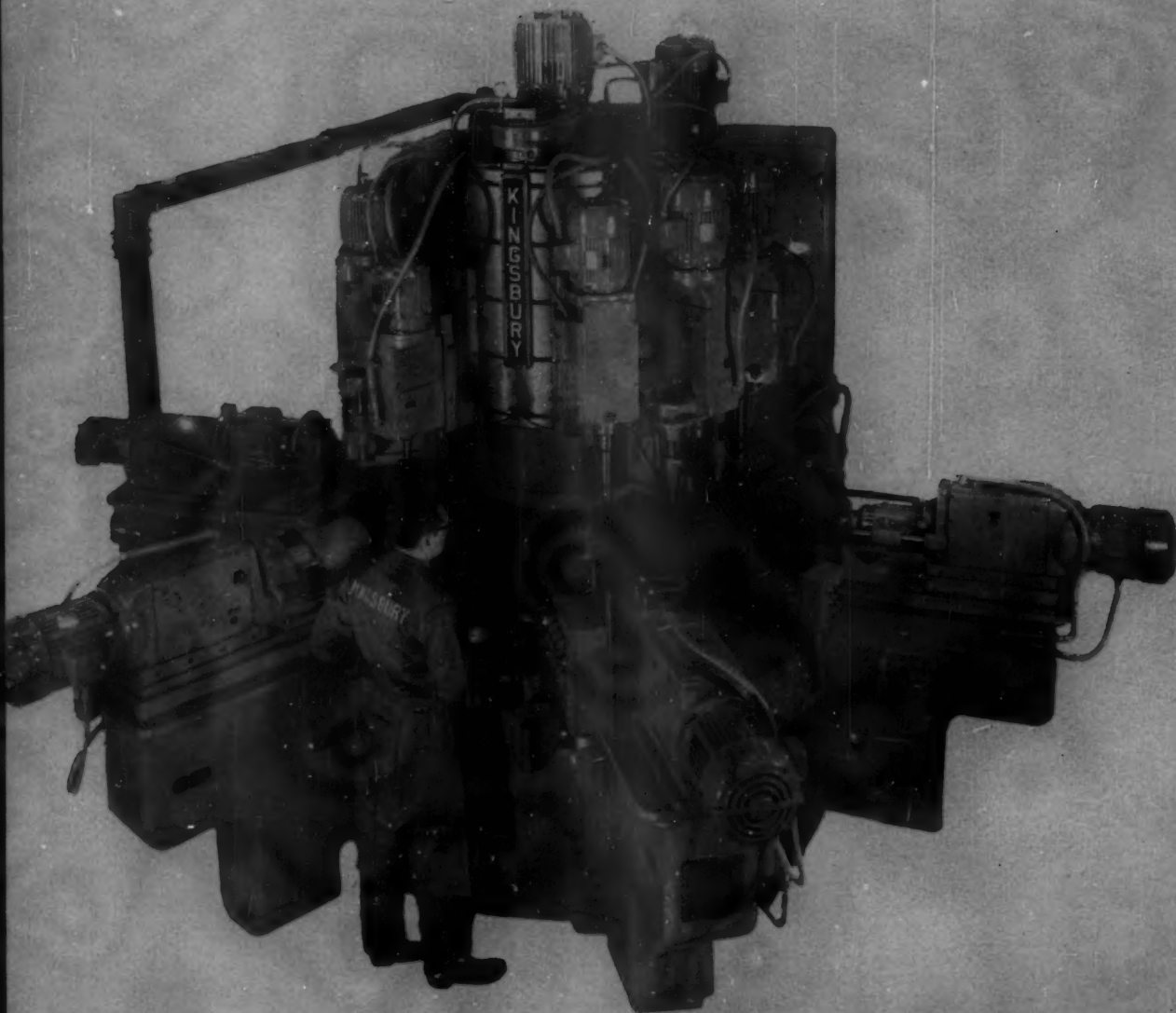
Used interchangeably for surface broaching, internal pull-down broaching and internal push-broaching, this No. RD-5-30 machine can perform either individual or multiple operations. It is available in four sizes with 4 to 10 tons capacity and with 24 and 36-inch stroke. Colonial Broach & Machine Co.



Intended for squaring the ends of bar stock of any length, Lapointe's No. HP-30 horizontal hydraulic pull type broaching machine can accommodate bars up to a maximum of 5½ inches square. The 15 ton machine has a hydraulically operated vise type fixture. Designed to run integrally with the fixture, the broach removes a maximum of 0.064 inch of material per pass. A dial indicator graduated into thousandths of an inch determines the correct length of the part when squaring the second end.

building-block machines and units

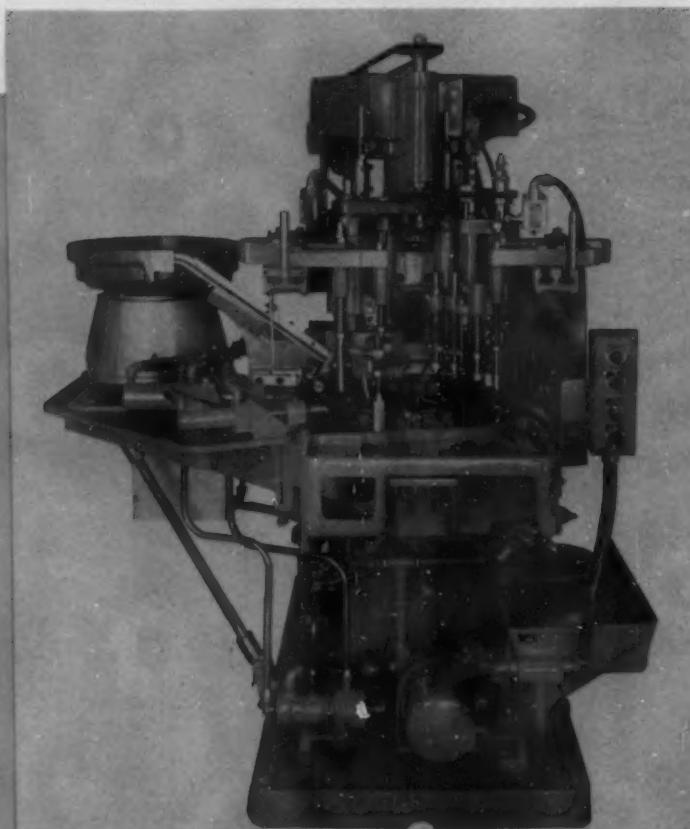
The building-block or modular approach—in which machines are constructed from standard tables, ways, machining heads and the like—has a tremendous potential for reducing design-and-build time and cuts change-over time for users.



Kingsbury rotary index machine has a 63-inch table. With 12 stations and 17 automatic units—10 on the center column and 7 on wing bases—the machine can perform a variety of drilling and tapping operations

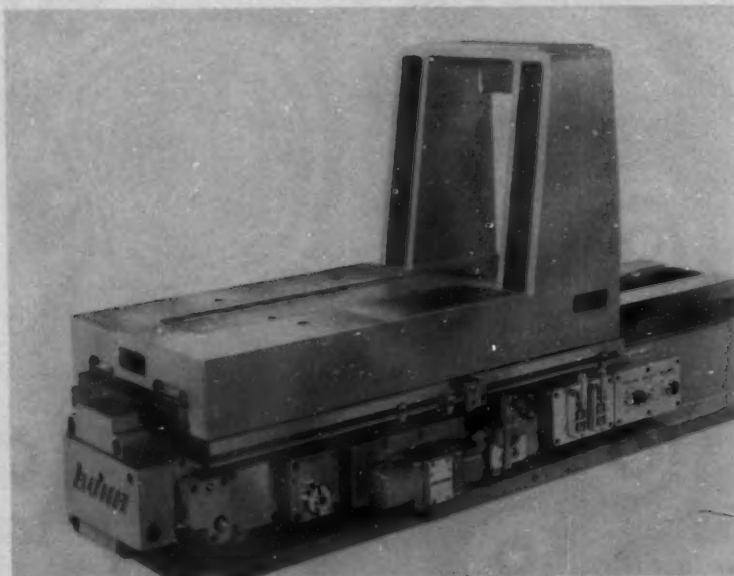
in one chucking. With other attachments, the machine can perform milling, boring and recessing operations as well. Attachments include an oscillating head and a speeder that runs at 14,800 rpm.

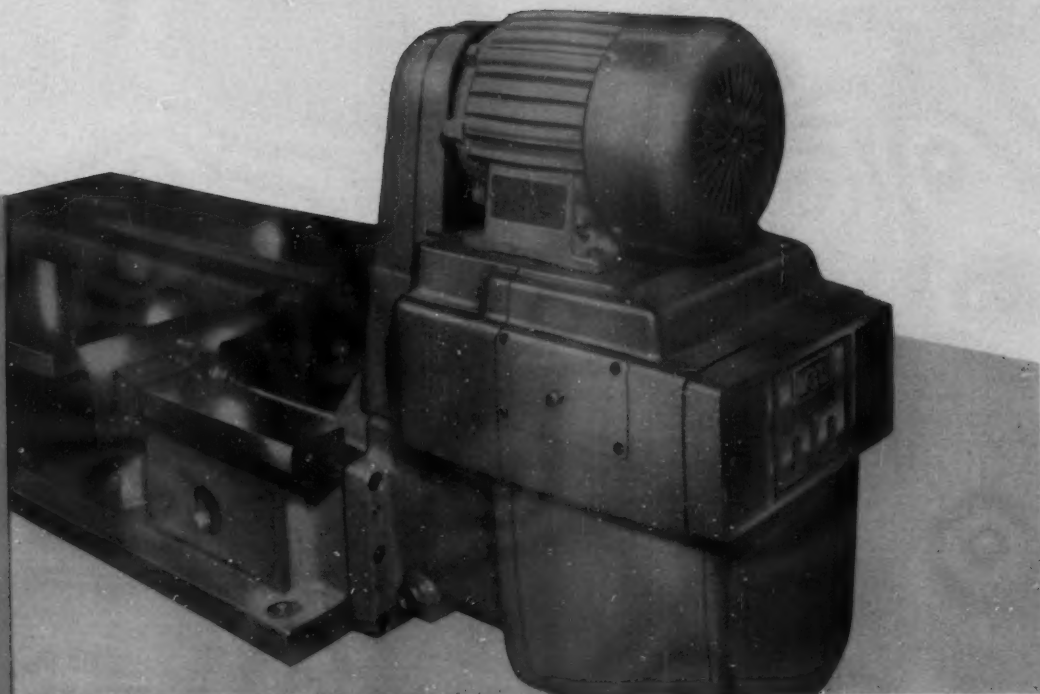
building-block machines and units



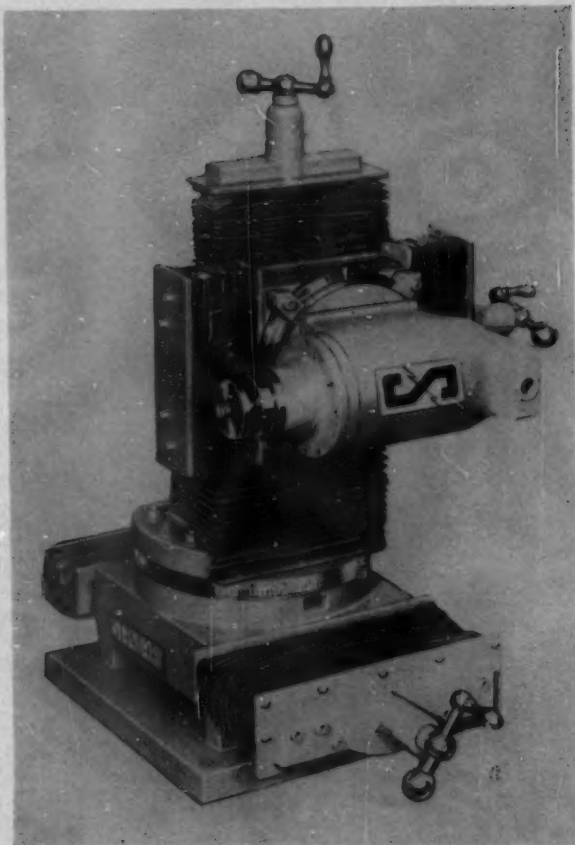
Illustrating the ability to produce a special machine from standard units, this Bodine No. 41-20 machine with standard chassis is tooled to turn out squeeze type B-X connectors. With a speed of 25 spm, the machine performs 8750 operations and completes 1250 pieces per 50-min hr. The operator loads a malleable casting into a nest type fixture. The top ear is drilled, the bottom ear is tap drilled, then tapped, and a screw is driven through the first ear into the second. After an inspection probe checks the screw's position, a slot is milled on the top ear. The screw is then staked and the completed part ejected.

Buhr hydraulic way type feed unit is one of a newly designed line of building block units. The unit illustrated has an integral motor bracket. It is equipped with a readily removable cartridge type hydraulic cylinder; manifolded lubrication to the detachable ways; a built-in check valve to eliminate surges; and a differential circuit that reduces oil consumption.





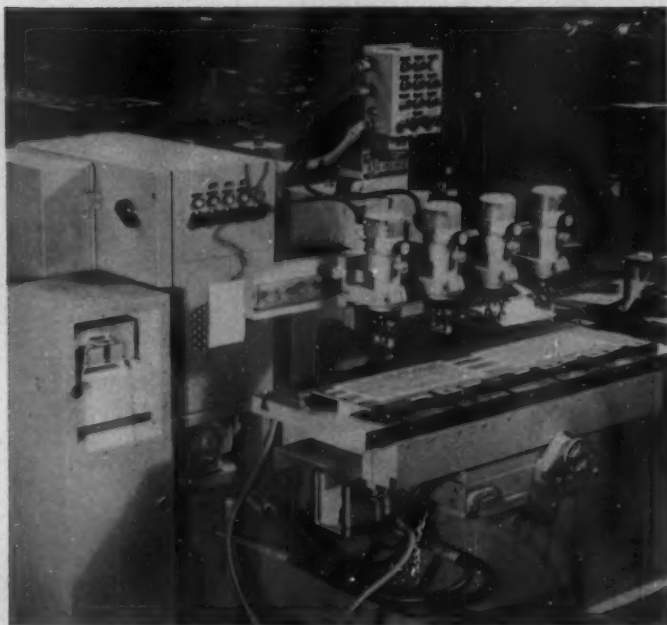
Designed with a thrust capacity of 30,000 lb, this new No. M-30 mechanical unit made by Barnes Drill Co. can be incorporated in a complete range of horizontal and vertical drilling applications. The unit, powered by a 2-hp feed motor, has a planetary type, all spur gear drive. To meet varying job requirements, the spindle motor can be furnished with output up to 30 hp.



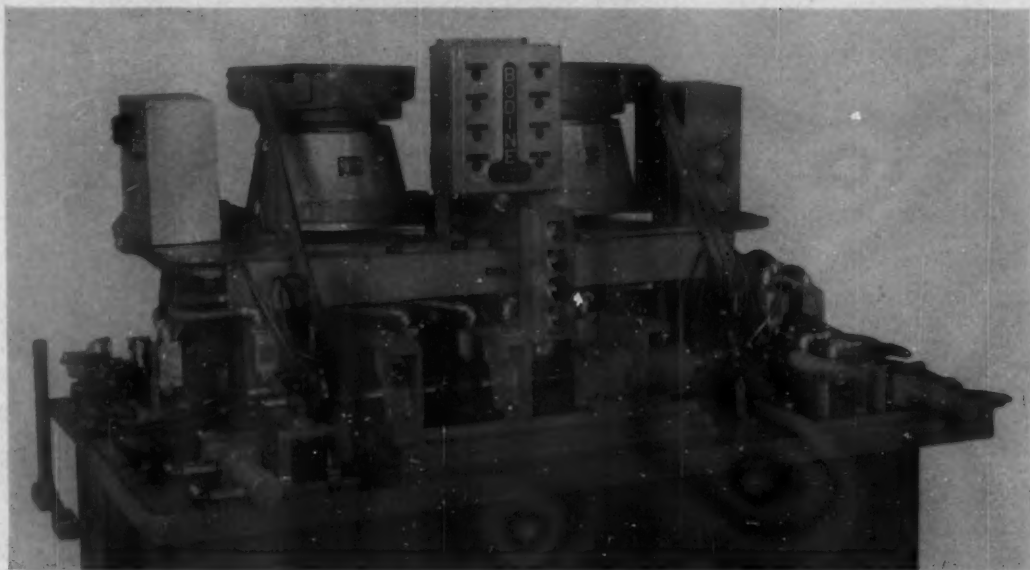
Supported by a positioning feed, this building-block assembly has a 12-inch-diam, 360-deg horizontal swivel base with a vertical angle plate feed. An 8-inch-diam, 360-deg vertical swivel base permits angular positioning of the No. 6002 motorized grinding spindle, which has one horsepower. Building-block assemblies of this kind can be used in new machines or for modernizing existing machines. The Standard Electrical Tool Co.

drilling, tapping, reaming

One word—control—sums up drilling developments. Numerical control for greater hourly output. And control of hole size and finish through improved drilling machine design.



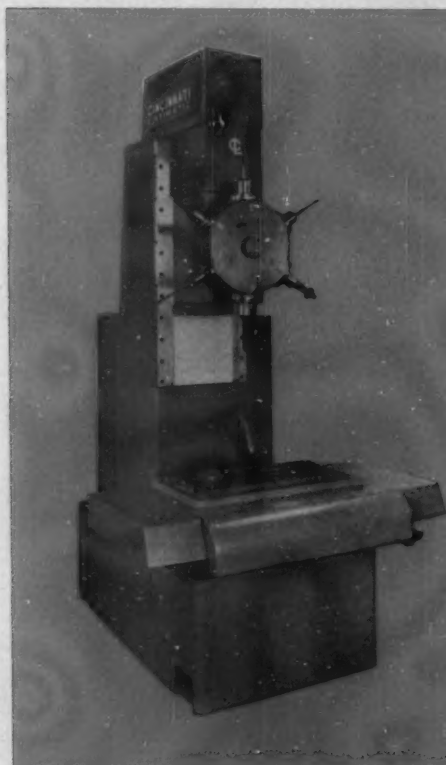
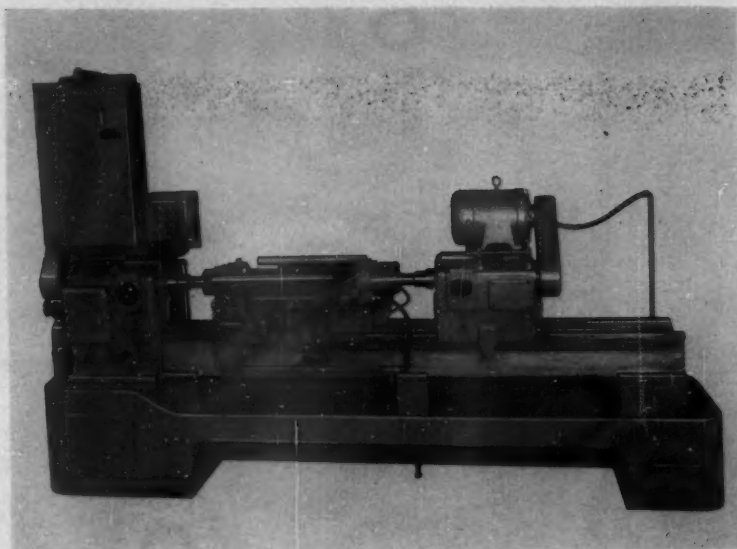
Jones & Lamson 20 x 20-inch positioning table operates under 1-inch, 8-channel tape control, with electronic hydraulic servo control for end point positioning. Set up in conjunction with a standard post drill, it demonstrates the speed and accuracy of tape control on small or long-run production.



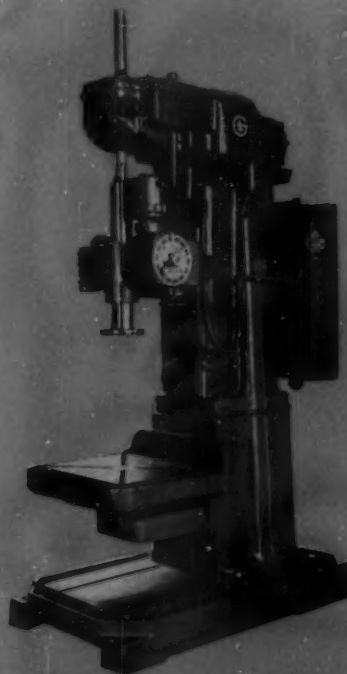
Essentially a leadscrew spindle with tap holders on each end, the spindle on Bodine's No. 58 double-ended continuous tapper is tapping on one end while withdrawing on the other. It is driven by a heavy duty reversing motor. Completely automatic, the ma-

chine will run approximately 65 spm tapping $\frac{5}{16}$ -18 holes in hard-drawn steel. Plug-in limit switches check for complete index, clamping pressure and failure of spindle stop switches or air pressure. Malfunctions stop the spindle and a light panel locates the failure.

Fitted with a walking-beam type loader and special vises, this drilling and centering machine is equipped for completely automatic operation. Shafts arrive by conveyor and two work carrier arms handle both rough and finished pieces simultaneously. Seneca Falls Machine Co.

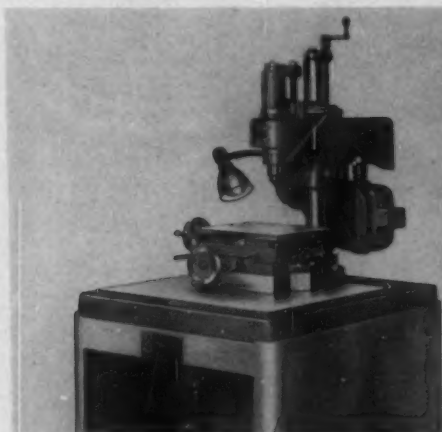


Cincinnati turret drill provides completely automatic drilling. Six tools may be selected at random from the turret. Selection is automatic from tape command or can be manually controlled. All six spindles are reversible so they can be employed for tapping. Spindle reversal is automatic at the depth programmed on the tape. Hole depth is controlled from tape commands. Both speed and feed rate for each spindle are also tape controlled. Feed rates are from 0 to 100 ipm; eight spindle speeds range from 190 to 3000 rpm. Cincinnati Lathe and Tool Co.

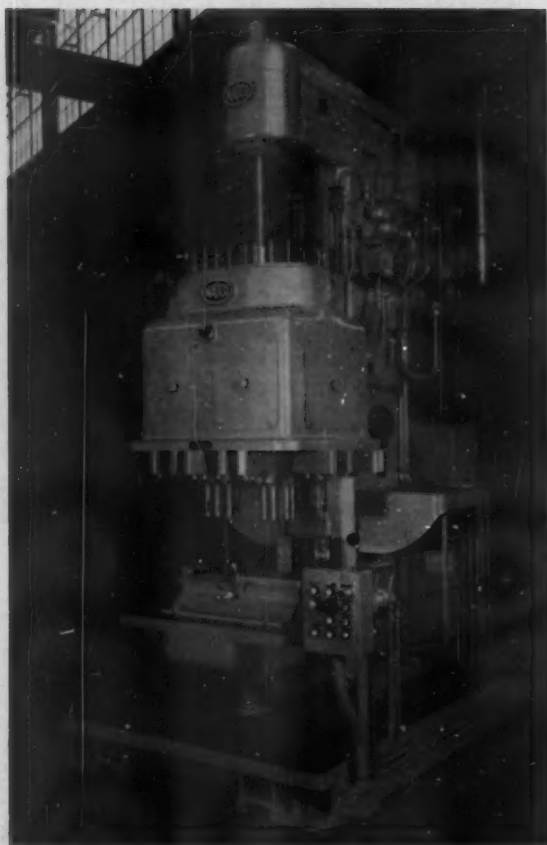


This 28-inch Giddings & Lewis upright drill with automatic single-cycle spindle control has an 8-spindle attachment. Available in models for automatic drilling only or for automatic drilling and tapping, the machine has a head-mounted control center with cycle start, spindle start, spindle jog, spindle drill and dwell or tapping, coolant, emergency return and motor stop. Limit settings controlling spindle modes are set up on a dial type selector located on the head. Used in conjunction with a fine-feed wheel, the cycle dwell control facilitates counterboring and spotfacing.

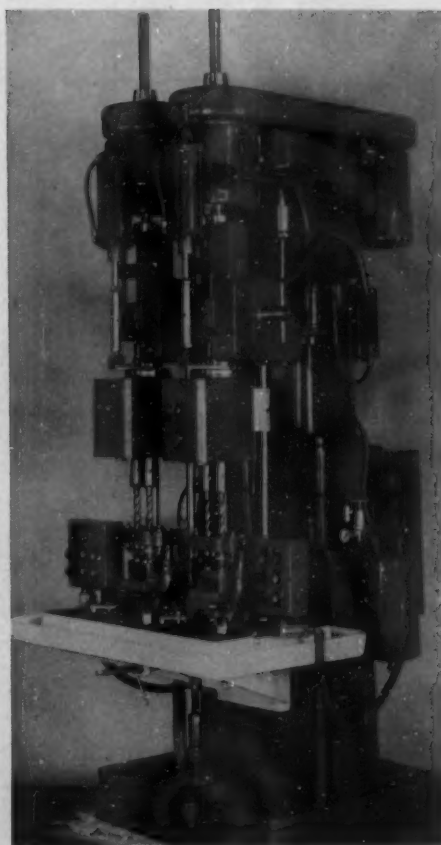
drilling, tapping, reaming



Intended for precision drilling of small holes, the Maximus drilling machine (Hamilton Tool Co.) has an 18x10-inch base and 22-inch column. Chuck capacity is either $\frac{1}{8}$ or $\frac{1}{16}$ inch. Drilling capacity is 0.004 to $\frac{1}{16}$ inch. Feed of chuck spindle is 3 inches. Speeds are 750 to 8750 rpm. Weight is 170 lb. The unit illustrated is mounted on a special steel stand.

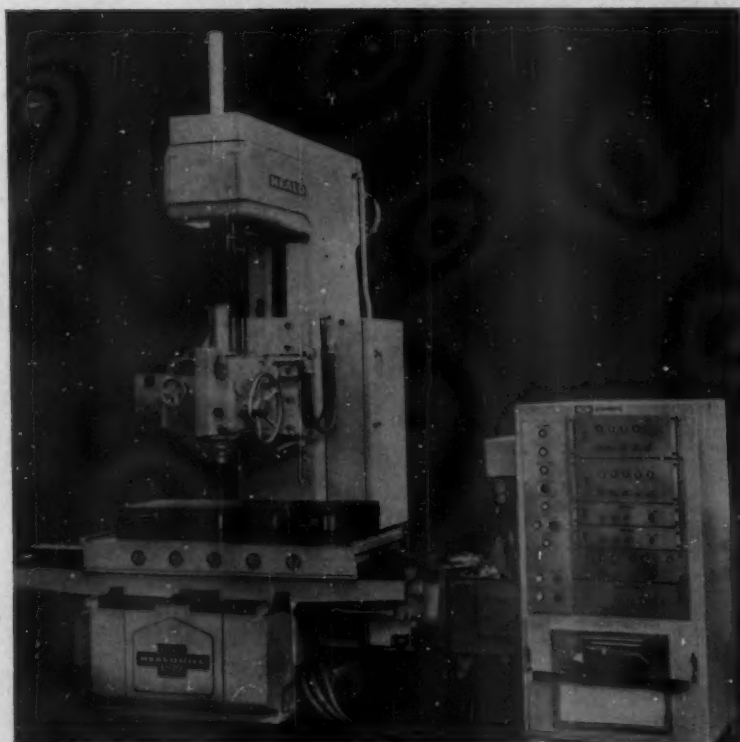


Natco F2B multiple-spindle drilling and tapping machine is equipped with a straight-line indexing fixture. Electrical circuits for fixture switching are built into the machine but all solenoids and hydraulic controls are mounted externally for easy maintenance. Both drilling and tapping spindles are in the same head. The machine has a 19 x 24-inch drilling-tapping area, a $7\frac{1}{2}$ -hp spindle drive and delivers 8100 lb thrust. National Automatic Tool Co., Inc.



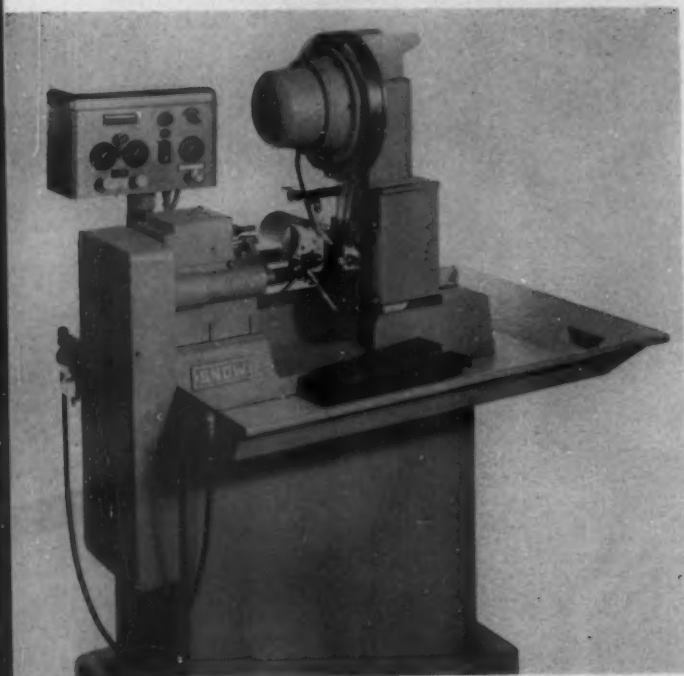
Equipped with two spindles, this No. 3 size drilling machine has positive drive power feed. The cycle is pushbutton controlled and consists of power rapid traverse and feed, and adjustable dwell, with torque limiting clutch in feed shaft. The power feed can be synchronized with index tables or transfer fixtures in automated production lines. Chas. G. Allen Co.

Burg Tool Mfg. Co.'s No. 3BHT-B tape-controlled 8-spindle turret drilling, tapping and boring machine has a 48 x 60-inch X-Y axis table positioning capacity. The spindle nose of the double housing planer type machine has 39-inch vertical clearance over the table. The turret feeds 12 inches independent of the bridge at any point from 39 to 3 inches above the table. Hole locations can be maintained within ± 0.001 inch total at any point on the table and positions are repeatable within ± 0.0005 inch.

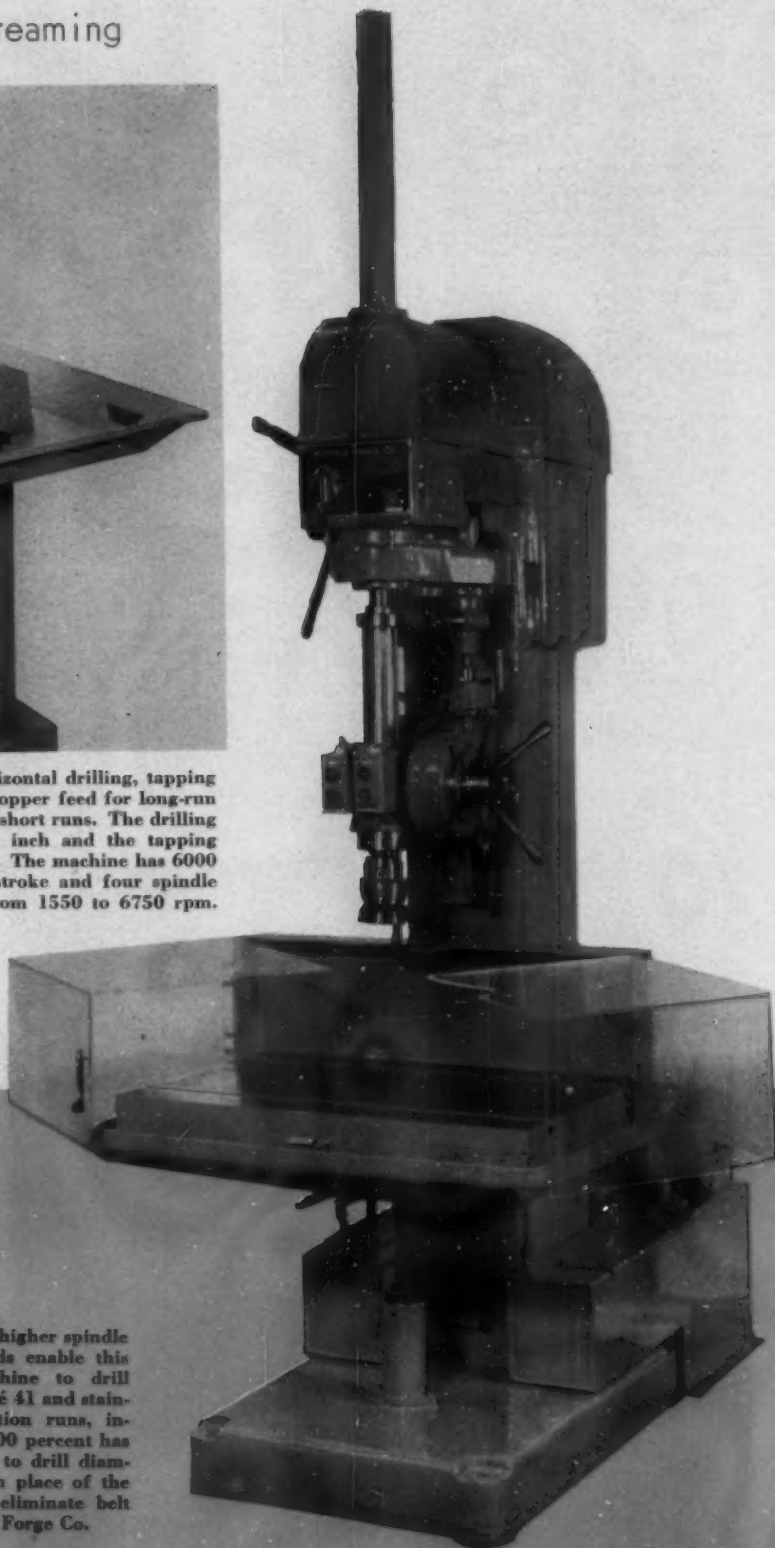


Heald's numerically controlled drilling machine permits direct programming of all functions: table positioning, speeds, feed rates and tool changes. The spindle depth control predetermines tool downfeed position. An automatic cycle enables the machine to operate unattended while drilling patterns of holes having the same diameter. The spindle speeds range from 30 to 1800 rpm and the spindle feeds, from 0.002 to 0.030 ipr.

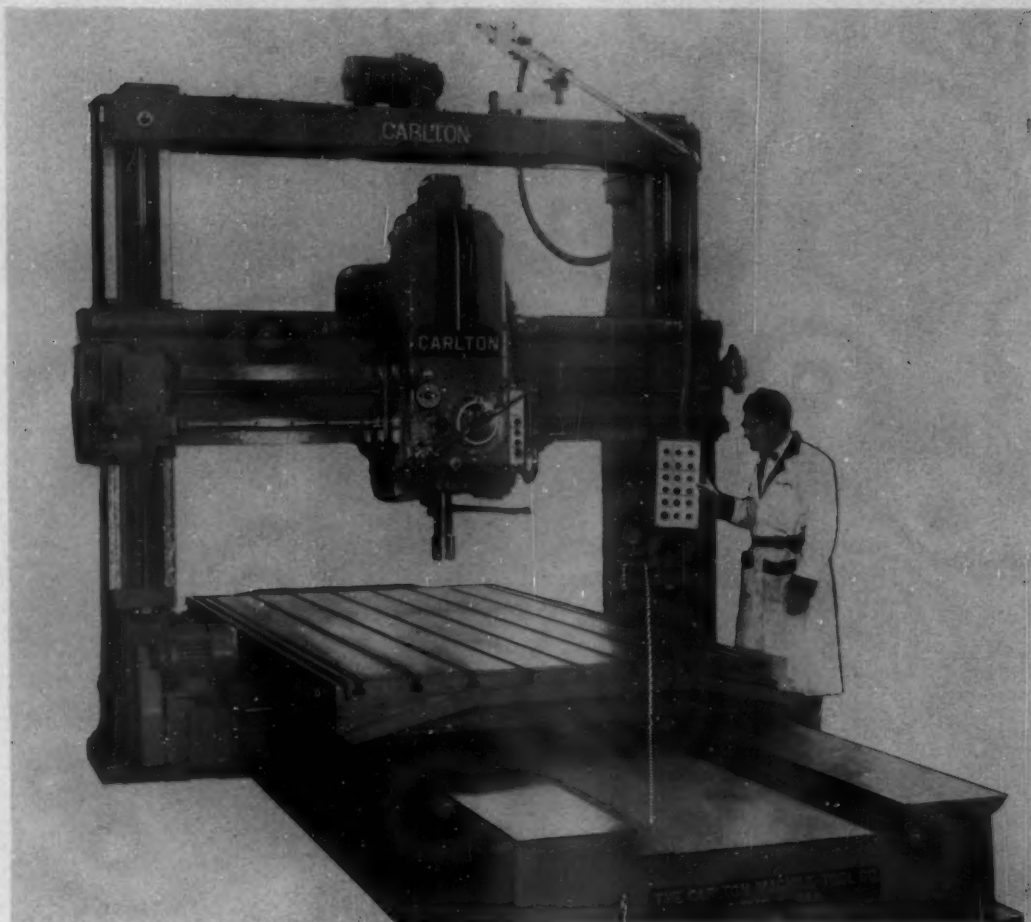
drilling, tapping, reaming



Snow Mfg. Co.'s No. 1-HD horizontal drilling, tapping and threading machine has a hopper feed for long-run operations and a hand feed for short runs. The drilling capacity is from No. 60 to $\frac{3}{4}$ inch and the tapping capacity from No. 0 to $\frac{1}{2}$ inch. The machine has 6000 cph output, a 2-inch spindle stroke and four spindle speed combinations ranging from 1550 to 6750 rpm.

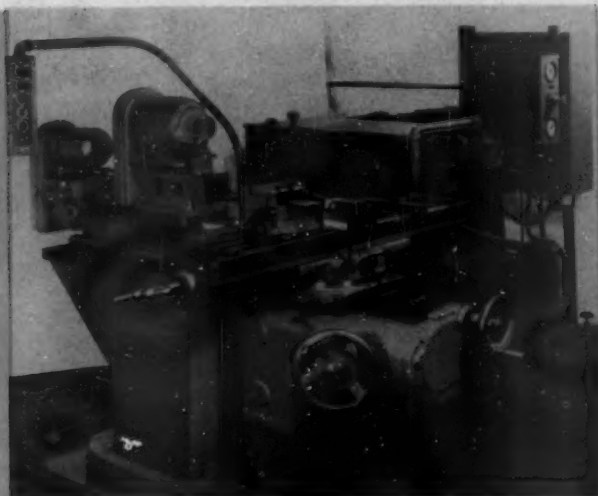


High-pressure coolant system, higher spindle speeds and special feed speeds enable this hollow spindle drilling machine to drill through titanium, Stellite, René 41 and stainless steel. In actual production runs, increased productivity of over 300 percent has been realized. Cuts are close to drill diameter. A timing belt is used in place of the conventional V-belt drive to eliminate belt slippage and take-up. Buffalo Forge Co.



This tape-controlled vertical drilling and boring machine has a planer type table with double housings and a bridge to support the crossrail. The table has a working area of 66 x 96 inches and a 25,000-lb capacity. Longitudinal table movement, transverse head motion and the speed and feed preselector are

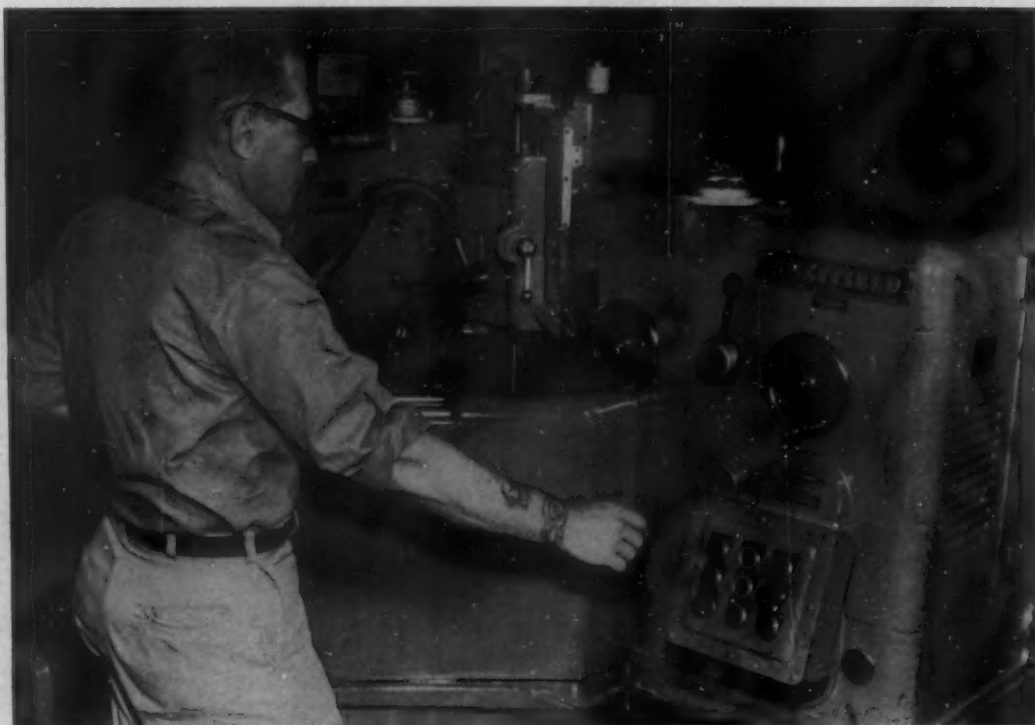
controlled by tape. Made by The Carlton Machine Tool Co., the machine has a 50-inch maximum distance between the table and spindle, with 38-inch vertical adjustment to the rail; 36 spindle speeds and 18 power feeds, which can cover a wide range of hole sizes; and a spindle powered by a 15-hp motor.



This Brown & Sharpe deep-hole drilling machine combines workholding capacity for short-run operations with machine rigidity. A newly designed column holds the drill unit, which produces holes up to 12 inches deep. The machine can be modified to hold a unit for drilling holes up to 24 inches deep. A 5-hp motor drives the drill at speeds from 2500 to 10,000 rpm. Used as a positioning fixture, the knee-saddle-table assembly enables the machine to handle work with a hole pattern covering a 12 x 12 x 28-inch area. The swivel table permits drilling angular holes up to 50 deg each side of zero. With a rotary table, radial holes over 360 deg can be drilled.

gearmaking

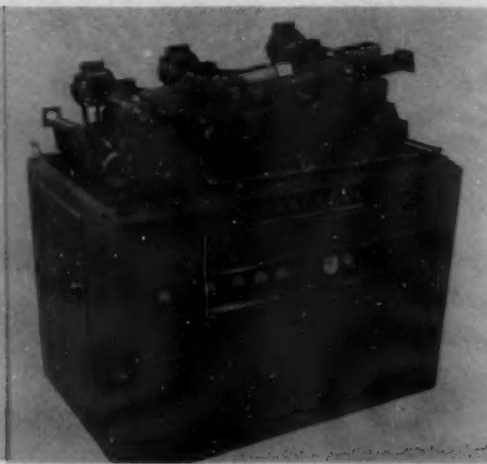
Two trends stand out in gearmaking—the trend toward automatic operation, with consequent greater productivity, and the trend toward higher precision to meet today's exacting requirements.

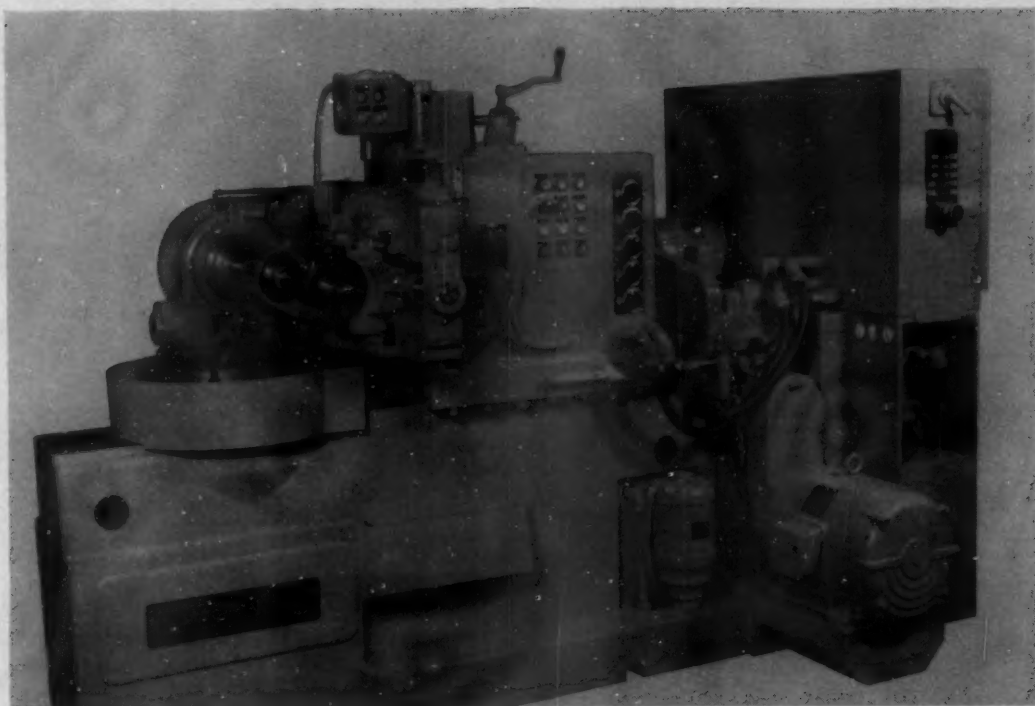


Capable of grinding external precision spur and helical gears from 8 to 100 diametral pitch, Sheffield's No. 140 gear grinder can grind several gears simultaneously from hardened steel preformed or solid blanks. The gear blank or blanks are mounted between head and tailstock centers. Rotating continu-

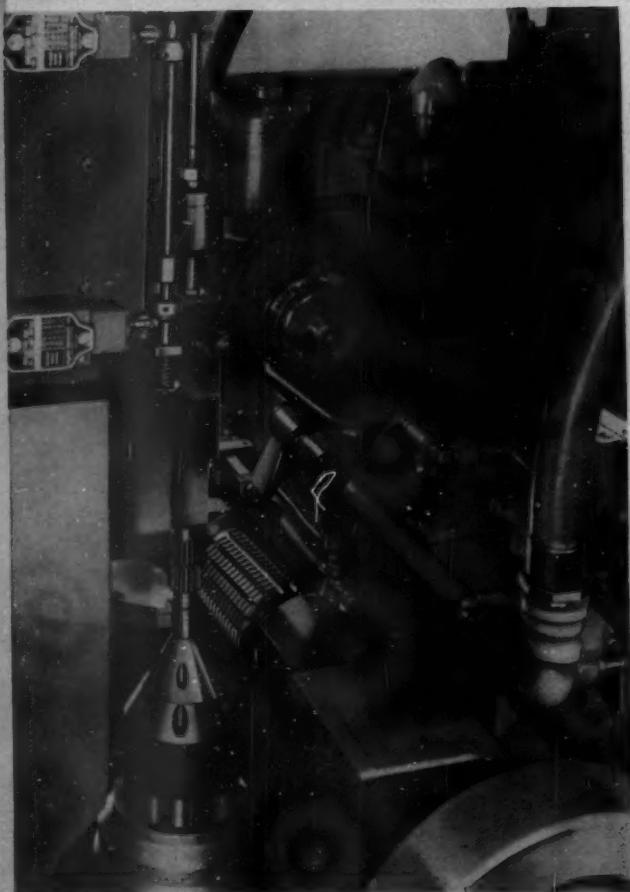
ously at a rate of speed synchronized with that of the grinding wheel, the work moves upward past the horizontal center of the wheel until the tooth form is imparted to the full face of the gear blank. Besides this hobbing motion, the work rolls across the full face of the helical rack form of the grinding wheel.

Inspecting up to 600 gears per hour, this automatic final gear inspection instrument has multiple stations to check all elements of gears. Complex signals control a memory device which accepts or rejects gears to prescribed tolerances and sorts accepted gears into size classifications for mating in assembly. The memory device and its counters control production equipment, stopping production as parts begin to fall out of tolerance. Parts can be fed automatically through the inspector by gravity-fed conveyors or by indexing mechanisms which control flow to prevent nicking. Illinois Tool Works.





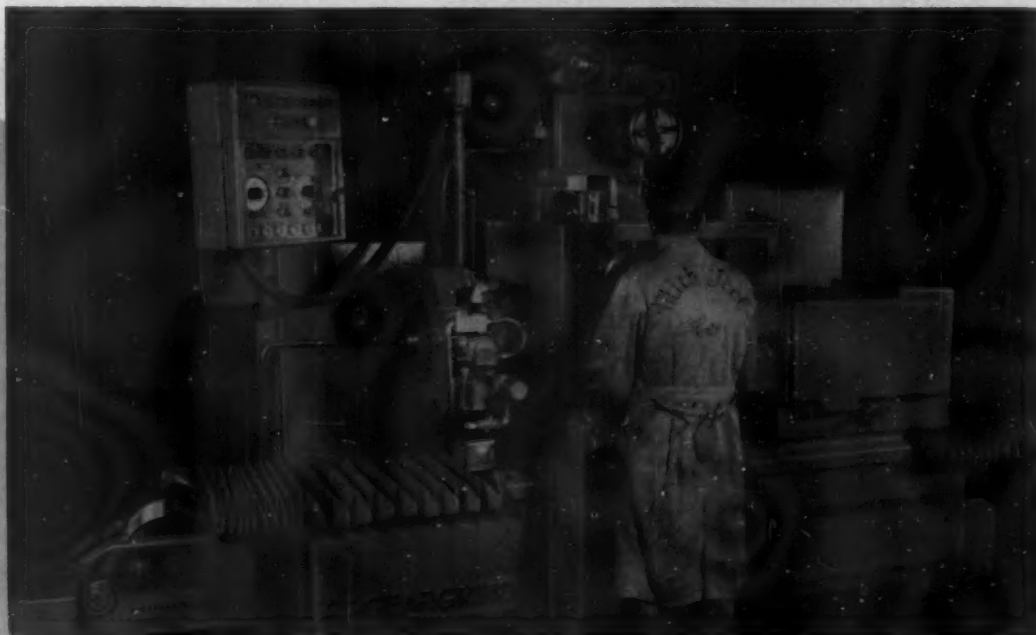
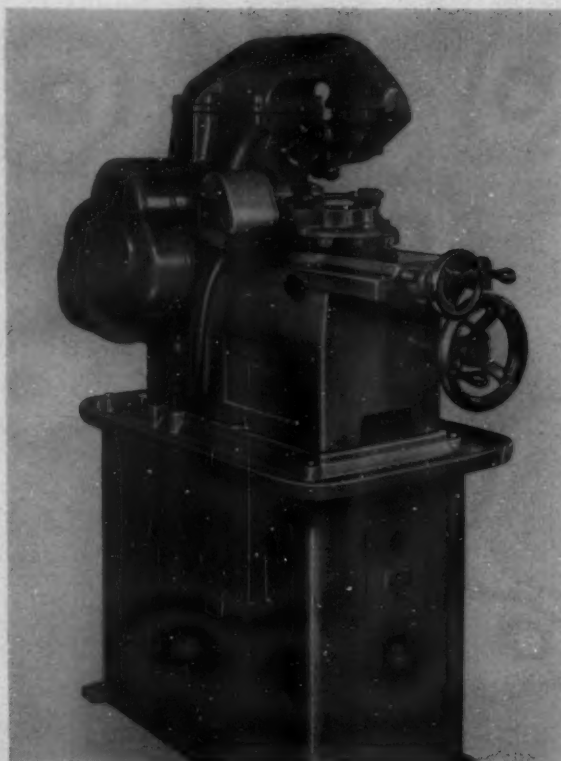
Model 20 TWG tangential worm gear hobbing machines are intended for high production of single and double thread worm gears up to 3-inch circular pitch. Both hobs and carbide-tipped fly tools can be used. The machines are available for in-feed hobbing of single-thread worm gears, tangential hobbing for multiple thread gears or with an infeed-tangential feed combination for tapered hobs. Norton Co.



Designed to be tooled for automatic loading, the Barber-Colman No. 4-6 vertical hobbing machine has automatic cycling that includes carriage feed, retraction after the cut and rapid carriage traverse to the starting position. The maximum hob speed is 614 rpm and the maximum feed is 0.150 ipm. The maximum work diameter is 4 inches, the maximum face width, 6 inches and the maximum hob diameter, 3 1/4 inches. A shuttle picks up the blanks and unloads the finished work.

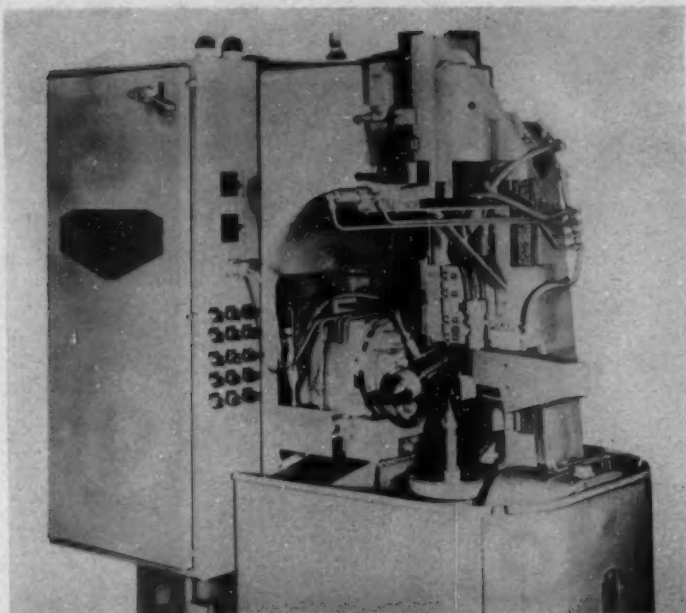
garmaking

Having a 6-inch maximum workpiece diameter, Hamilton's No. 1-B precision gear hobber generates spur gears, spiral gears, bevel gears, worm gears, splined shafts, gear sectors and pinions. Delivering 12 hob speeds from 109 to 1259 rpm, the 1-hp machine hobs any number of teeth between 3 and 130, any multiplier or even number between 130 and 260 and any multiplier or number divisible by 5 between 260 and 325. The speeds, feeds and indexing can be selected independently. Revolving on a large-diameter cylinder, the hob spindle turntable swivels 120 deg to the left or the right.

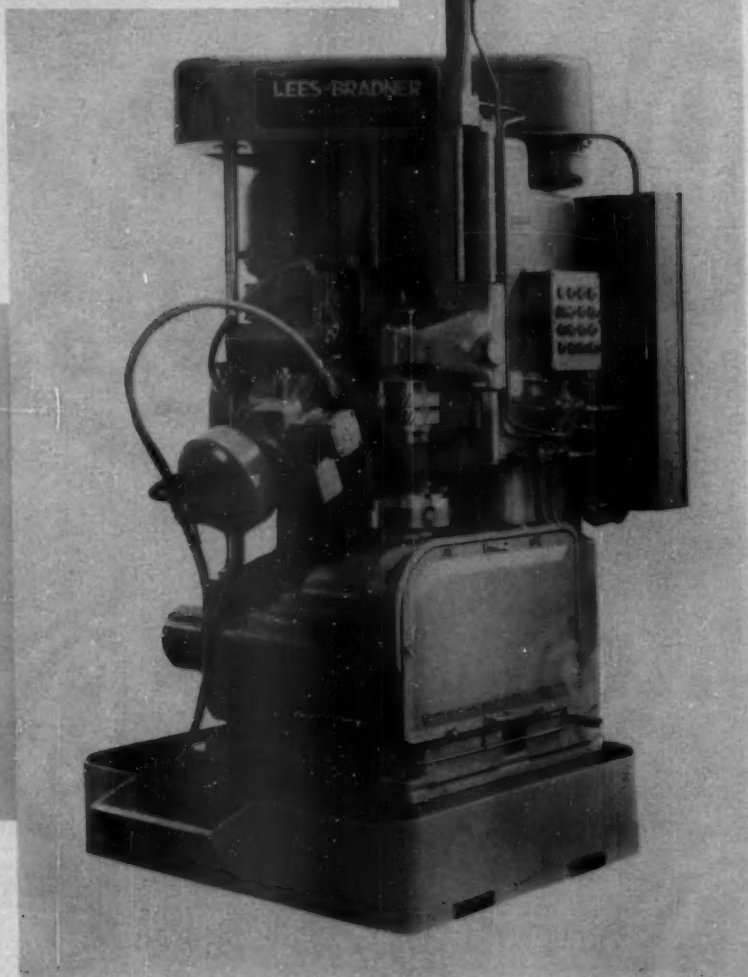


Twin grinding wheel standards, which carry the grinding wheel head, and oscillating drive are mounted on the base of Michigan Tool Co.'s Model CCG fully automatic crowning gear grinder. Sliding on base ways, a carriage carries the work, mounted in a fixture fastened to the index head. A 16-inch-diam master index plate governs the tooth spacing. The crown

radius can be up to 12 inches and the maximum oscillation angle is 90 deg. For spur gear grinding, the motorized spindle is locked to prevent oscillation. Typical worktable maximum speeds for the grinding of spur gears are: 116 cuts per min for 2-inch face width and 88 cuts per min for 4-inch face width. The grinder has a maximum stroke of 17½ inches.



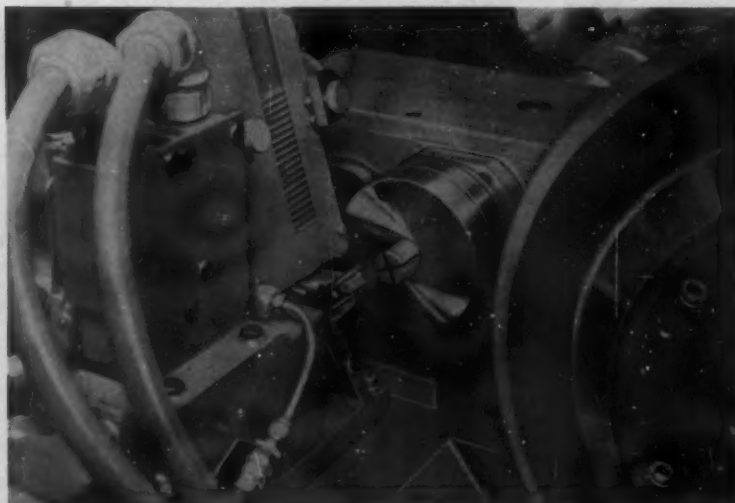
Cleveland No. 188 single-spindle gear hobber has an automatic shifting hob-head for maximum hob life and a helix and lead corrector (sine bar) for instantaneous correction of lead error without stopping production. Other features include automatic feed cutout, infeed and outfeed, "Q" cycle and automatic loading. The machine will hob helical gears, spur gears and splines up to 20 inches in diameter. Cleveland Hobbing & Machine Co.



Single-spindle vertical production hobbing machine will hob large, heavy gears up to 12 inches in diameter. This Model 12HO 12 x 20-inch machine is capable of operating at high speeds, cutting with a precision usually associated with cutting smaller gears. The guard has been removed from this machine. The Lees-Bradner Co.

grinding

Higher horsepower, automatic size control, tracer and numerical control—these are some of the outstanding developments in grinding.

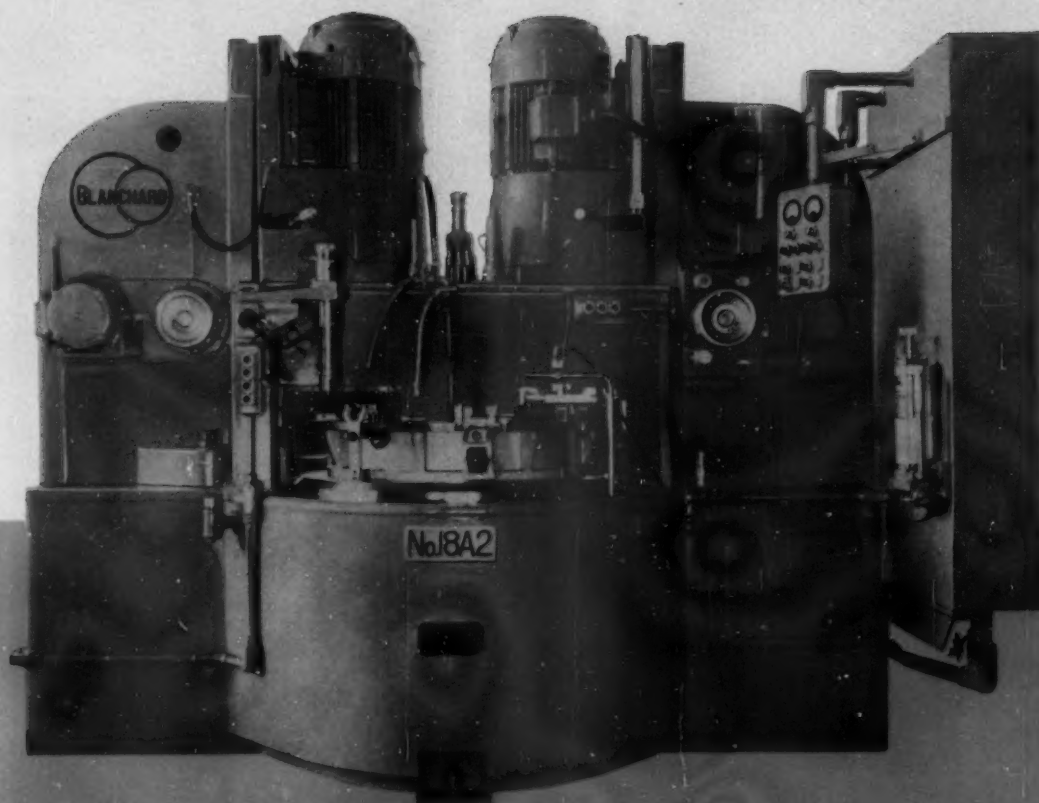


Intended for high-production thread grinding of small parts, this Jones & Lamson Model F grinder is applicable to thread-grinding operations on all standard taps, with manual or automatic handling.



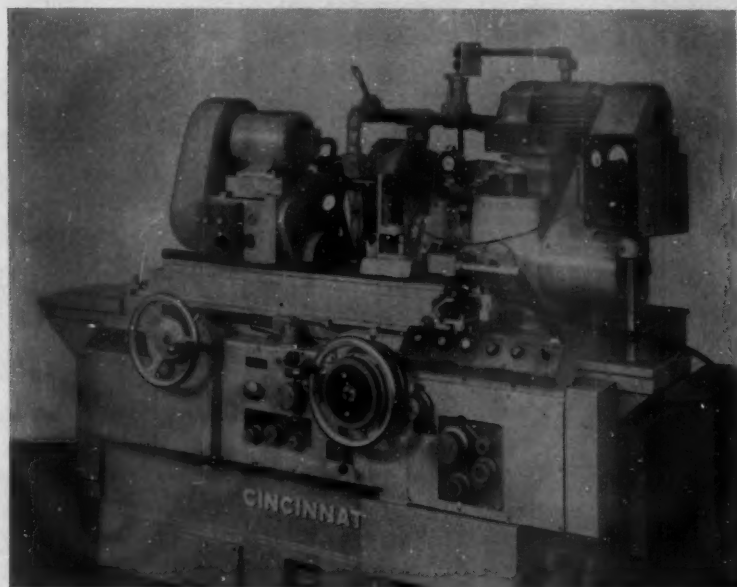
Designed to grind multiple grooves simultaneously in rod mill rolls up to 60 inches long x 14 inches OD, Sheffield's No. 181-A roll grinder has fully automatic grinding and crushing of the wheel. The 20-inch OD x 4-inch wide grinding wheel is initially formed to the desired profile by an automatic device which

also redresses the wheel after wear. The machine has variable speed control for automatic fast and slow feed of the wheel into the work and an automatic plunge grinding device with 1-inch rapid approach and retraction of the wheel. The grinding wheel has speeds of 1150, 1270 and 1390 rpm.



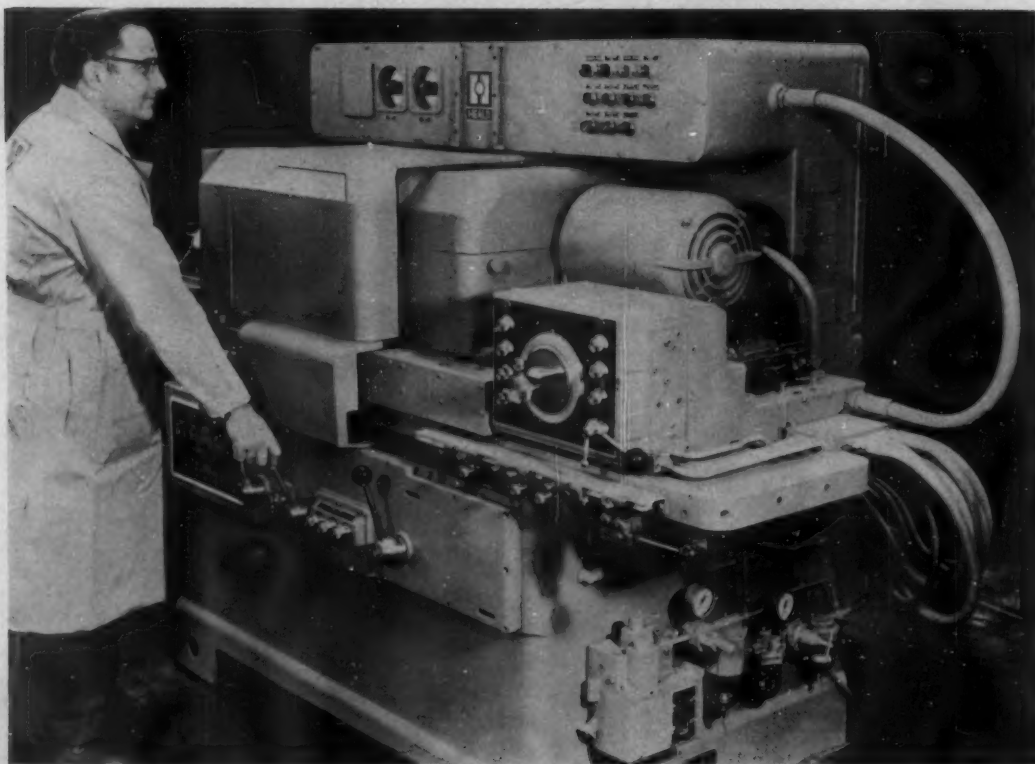
Equipped with 30-hp foot type spindle motors, Blanchard Machine Co.'s No. 18-A2 2-spindle automatic surface grinder has a plain table for the mounting of special workholding fixtures. A 6-speed gearbox for table rotation can be locked in a preselected

speed. The feed rate, in thousandths of an inch per minute, can be locked by the setup man. In operation, all coolant and chips flow out of the grinder to an outside settling tank or central coolant system. A light flashes when grinding wheels need replacement.



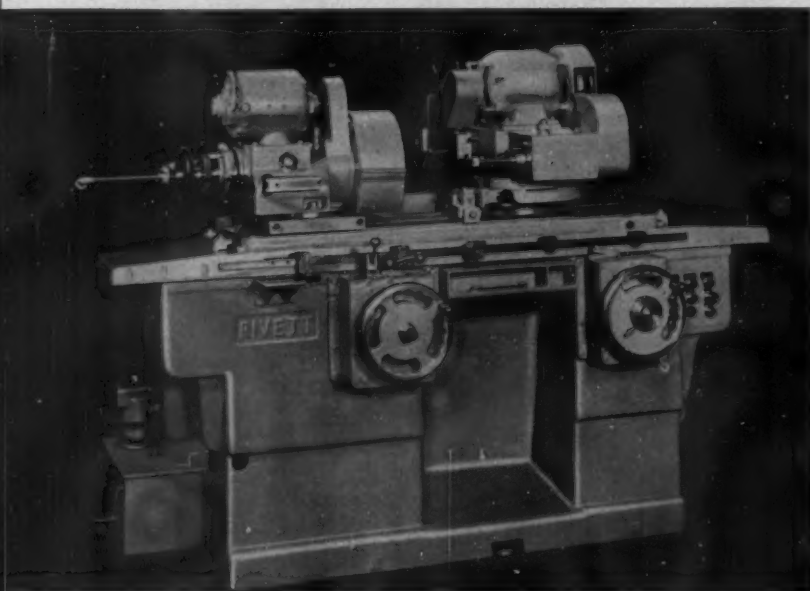
Equipped with grinding wheel spindle bearings that are self-adjusting for heavy roughing and fine finishing cuts, Cincinnati's size 340-20 centerless grinding machine has 40-hp drive and a 20-inch-wide wheel for through-feed and infeed grinding operations. The maximum work diameter accepted by the machine is 6 inches. In two passes of the work, this wide wheel grinder will remove as much stock as removed in six passes on a grinder having 6-inch-wide wheels.

grinding



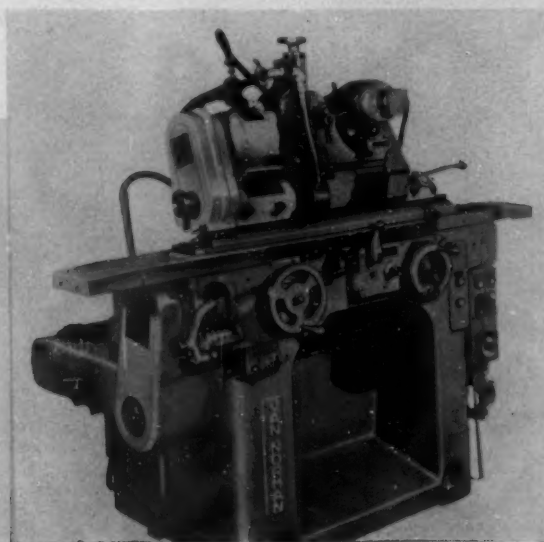
Designed with the wheelhead mounted on the cross slide and fed into the work to allow heavy roughing cuts, Heald's No. 171A internal grinder has a workswing to 8 inches OD and a 90-deg included angle. The feed, which advances the wheel only at reversals of the table, permits improved finish and straightness

on long bore-to-diameter ratio parts. To improve wheel life and tolerance control, the machine has a 0 to 0.004-inch infinitely variable compensation for wheel wear. Hydraulic power and lubrication oil units are located outside the machine base to prevent thermal distortion. A Size-Matic unit is shown.



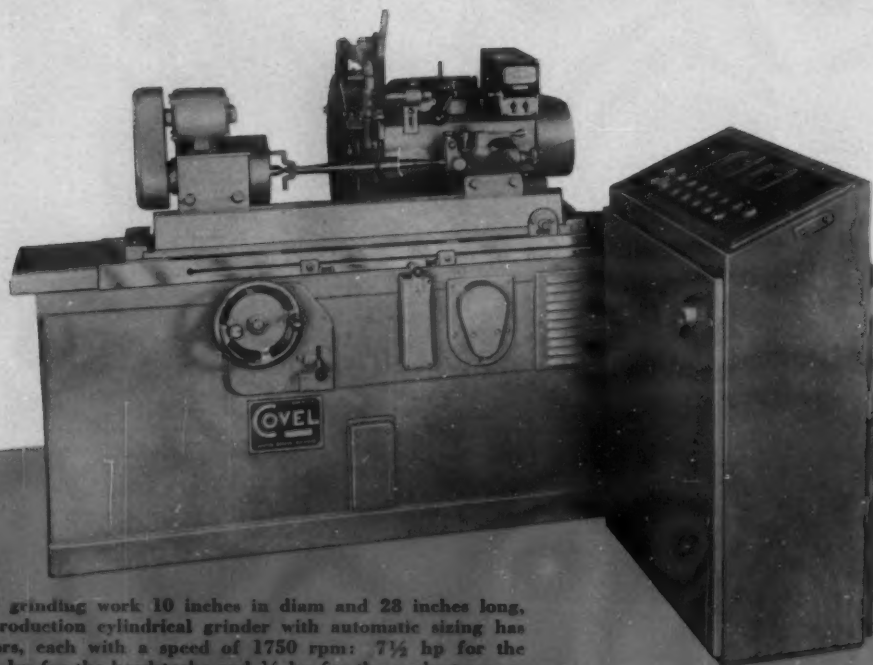
Setup time is reduced with this No. 1024 internal and universal grinder manufactured by Rivett Lathe & Grinder, Inc. The double-end wheelhead swivels 180 deg for quick conversion to internal or external work. Up to 9-inch-diam holes can be ground to tolerances of $+0.0003$, -0.0000 inch.

Through the operation of an eccentric workholding fixture in a horizontal plane, this vertical cam grinder permits increased production of contoured bores. The machine, made by Bryant Chucking Grinder Co., is of unit type construction and requires a minimum of floor space.

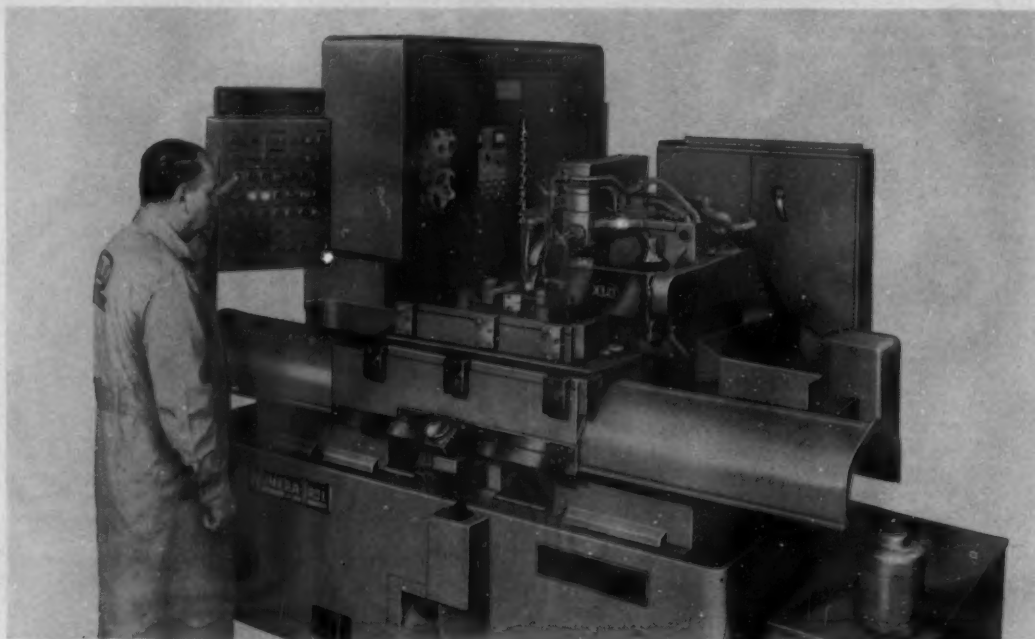


An optional sure-set taper indicating gage on Van Norman's No. 418 grinder allows exact swivel table adjustment to eliminate taper or produce a specific taper. It enables the operator to know the actual table position at all times. A crush forming attachment permits contour grinding and less wheel dressing. The manually operated controls on this attachment include rapid traverse downfeed and lock levers and a fine-feed handwheel graduated in 0.001 inch increments.

grinding



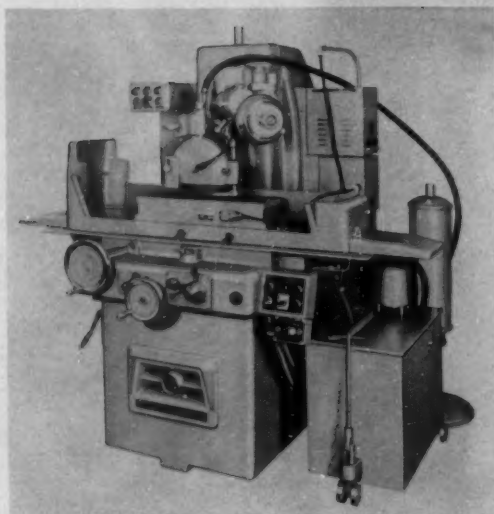
Capable of grinding work 10 inches in diam and 28 inches long, No. 42A production cylindrical grinder with automatic sizing has three motors, each with a speed of 1750 rpm: 7½ hp for the spindle, ½ hp for the headstock; and ¼ hp for the coolant pump. Table traverse is 0-150 ipm. The 18-inch-diam grinding wheel is 3 inches wide with a 5-inch hole. Final size is attained to tolerances, in many cases, of 0.000050 inch. Covell Mfg. Co.



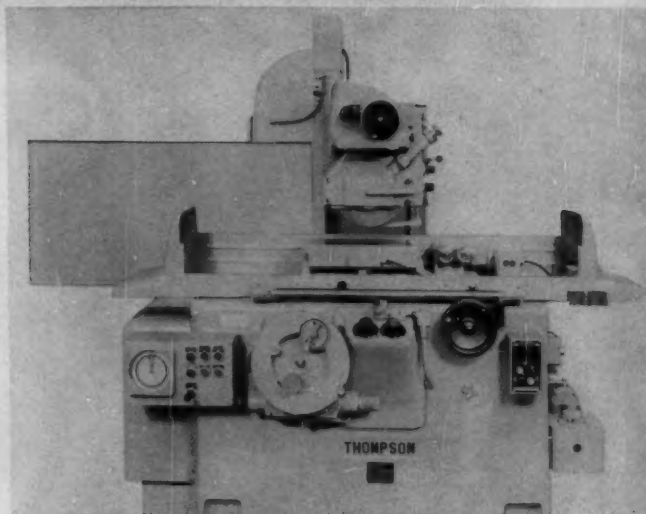
Numerically controlled by two or three dimensional tape, Ex-Cell-O's No. 922 Numera-Trol can be converted from a templet grinder to a boring and turning machine through interchangeable heads. The machine has a heavy bed, hand-scraped antifriction ways, preloaded ball thrust bearing supports on each

end and lead screws with recirculating ball type antifriction screw and nut assemblies. To overcome the initial inertia of the 1000-lb cross slide, 5½ lb direct pressure is required. Quantizers geared to the servo motors allow closed-loop feedback sensitive to incremental pulse values of 25 millionths of an inch.

Sizing equipment on the new Brown & Sharpe No. 5 grinding machine enables a semiskilled operator to plunge grind, on a production basis, to any predetermined size within 0.000010 inch. The removable cartridge type wheel spindle comes in either plain or antifriction bearing design. Headstock drive is through O-rings. Wheel sleeve and guard accommodate a 16-inch wheel.



This No. 300 Grand Rapids hydraulic feed surface grinder is equipped with incremental downfeed, making surface and plunge grinding completely automatic. The amount of stock to be removed is set to an accuracy of 0.0001 inch on a dial and vernier at operator eye level. The machine removes stock to the preset amount at a selected rate, always leaving 0.0001 inch of stock for a final pass before a three-pass spark-out. Gallmeyer & Livingston Co.



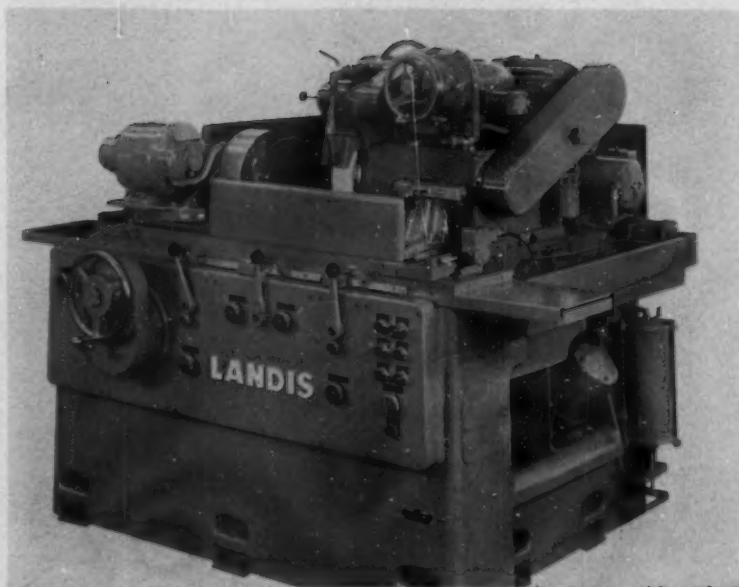
Equipped with a 3-hp 1800 rpm wheelhead motor and 12 x 1 x 4-inch grinding wheel, this Thompson 2F grinder has a table-mounted double-roll wheel crushing device. A hydraulic system provides table speeds from 5 to 90 fpm. Vertical movement is controlled by an automatic downfeed with a range of 0.0002 to 0.004 inch for table or wheelhead reverse and a micrometer back-up stop with a positive automatic downfeed stop for size control.

grinding

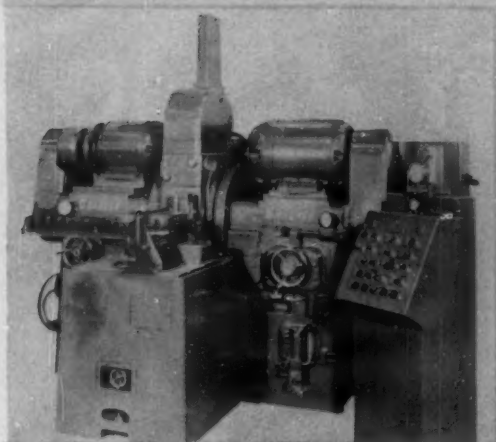
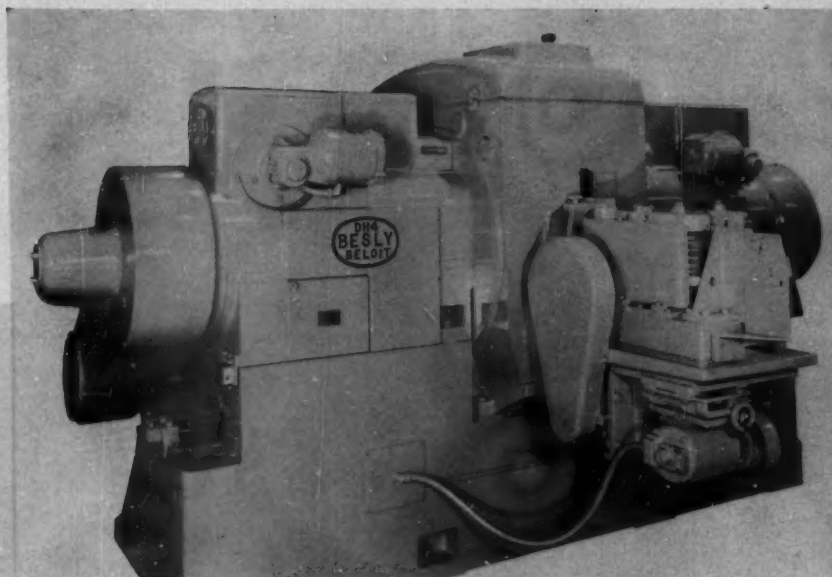


Precision to plus and minus 100 millionths of an inch is possible on this No. 12-231 single-spindle vertical grinder made by the Frauenthal Div. of the Kaydon Engineering Corp. An electrohydraulic tracer system with plus and minus 10 millionths of an inch electrical accuracy guides both vertical and horizontal axes simultaneously through 360 deg of motion. The machine has a 42-inch-diam table, a 52-inch-diam swing, a 27-inch stroke and infinitely variable feed and speed ranges with potentiometer controlled d-c drive. A continuous recorder shows deflection, indicating any variation from true contour path between the template and the work slide and giving a permanent record of contouring accuracy. Adjustable machine alignment permits readjusting of the cross rail to exact alignment with the table and the vertical slide.

Capable of grinding parts to size, straightness and roundness tolerances of millionths of an inch, this Landis 10-inch universal cylindrical grinder is equipped with Microfeed, a method of grinding with ultrafine wheel feed increments controlled by a single contact gage. A semi-automatic cycle plunge grinds to remove 0.003 inch of stock to finish size. A constant reset establishes the zone of operation for the next cycle, regardless of amount of feed used on the previous cycle. Wheel wear, machine temperature changes, wheel action and variations in the workpieces are automatically compensated for.



Almost any part having two parallel surfaces to be ground can be finished on this double-spindle grinder. The machine has push-button operation, accuracy to tenths, automatic dressing and sizing, and built-in dials, indicators and gages. Besly-Welles Corp.



Equipped with a variable speed drive and an improved ball sleeve abrasive disk dresser, this Gardner No. 2H30 precision double horizontal spindle disk grinder accommodates workpieces up to 10 x 2 1/2 inches. The dresser, an electric, heavy-duty bar type, can be adjusted to zero clearance and operates automatically when the operator pushes a button. The workpieces are hand oriented into a loading chute and gravity fed to feed belts transporting them between the grinding disks. After grinding, a gravity conveyor returns them from the exit point to the front of the machine.

Type TS hand-operated surface grinders are made in two sizes, 6 x 12 inches (illustrated) and 10 x 16 inches, with 7-inch and 12-inch grinding wheels, respectively. Precise two-speed vertical feed, calibrated to 0.0001 inch, is an important feature of both sizes. The larger model has provisions for changing wheel speed as the wheel wears or when a smaller wheel is used to grind a large workpiece. Parts as high as 12 inches can be ground with either model, using the standard sized wheel. Norton Co.



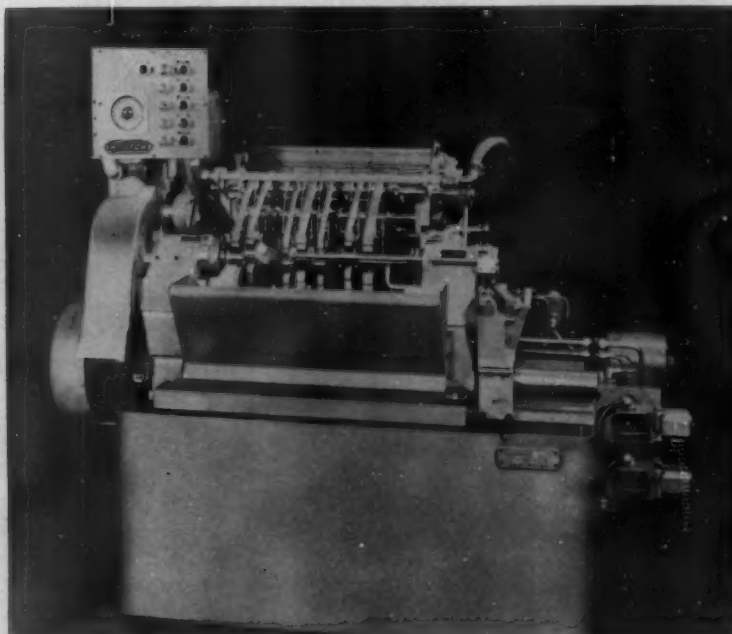
honing, lapping, finishing

Modern machines are capable of generating finishes as fine as one microinch—and at high production rates.



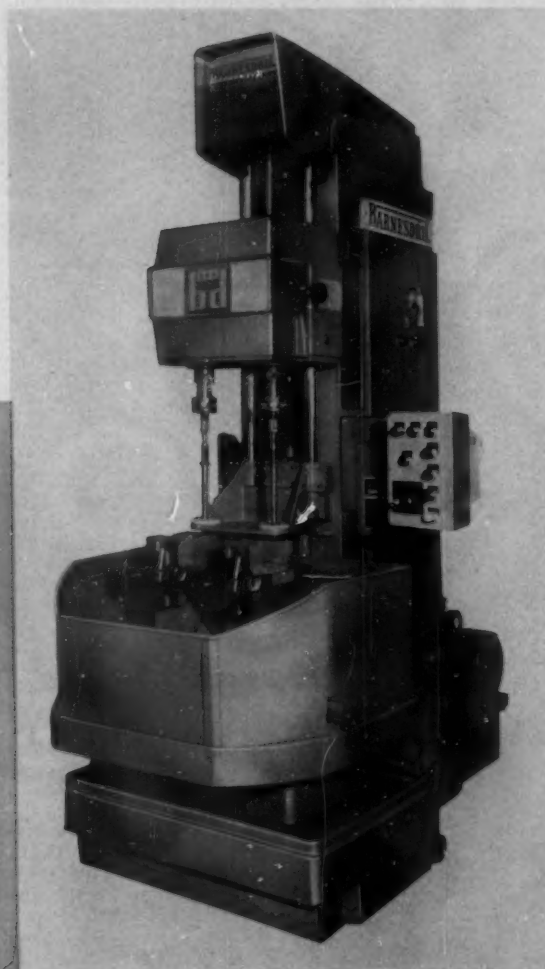
Controlling critical functional characteristics of curvature, waviness and surface roughness and lay, Micro-matic Hone Corp.'s No. 2HRI-5 bearing raceway microhoner automatically handles the races on a multiple-spindle setup. The machine can be designed for

one, three or five (illustrated) spindle operations and can be completely automatic, including loading, ejection, cycling and feeding of the abrasive. At a rate of 600 per hour, the machine hones inner bearing raceway rings. Stock removal is 0.0003 inch.



Coated abrasive strips are used to lap the main diameters, pin diameters and the seal diameter of crankshafts in this No. 31 crank lapping machine. Surface roughness is reduced to about one-third in the average application. Thus a 30-microinch (rms) ground finish is lapped to 10 microinches. Norton Co.

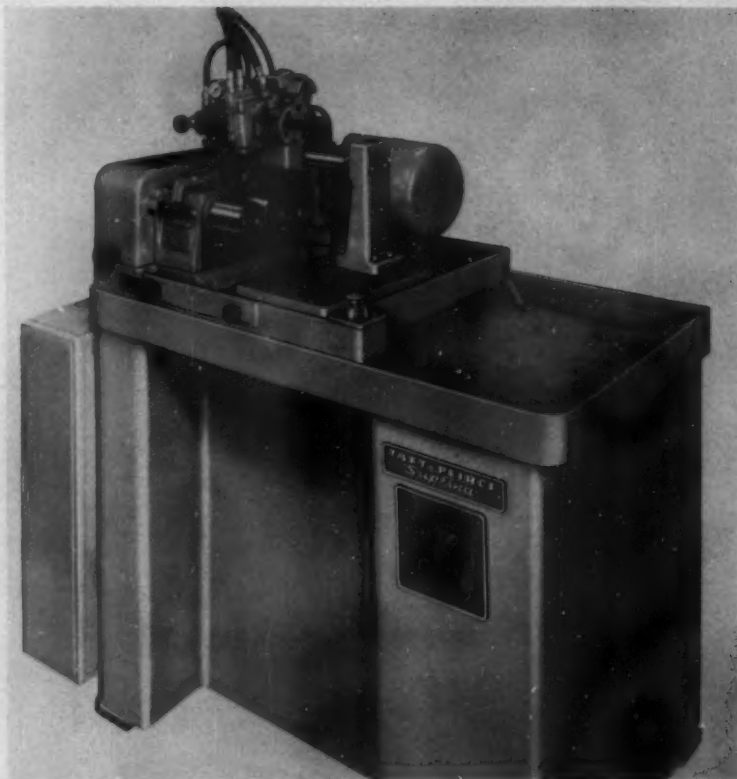
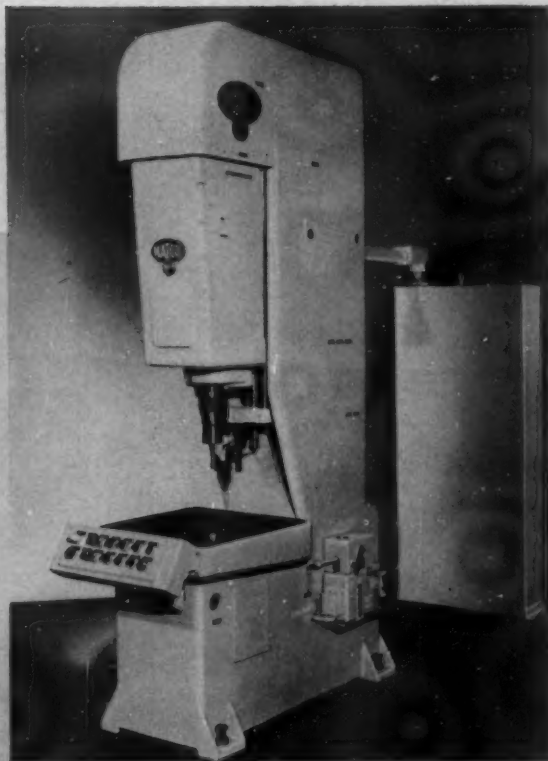
Equipped with automatic size control, this Gisholt No. 81 single-spindle superfinisher handles flat, conical or spherical surfaces. The machine requires a minimum of floor space and can be readily adapted to automatic work-handling. It can finish flat ring surfaces in 20 sec. floor-to-floor time.



Available with stroke lengths of 15, 25 and 40 inches, and a choice of one or two spindles, this No. 244-2 vertical honer with Pneumatic sizing hones 4-inch-diam bores at full stroke. Electric panels are positioned behind hinged doors in the column. For full automation, the machine can be equipped with automatic compensation for stone wear and electric hone expansion. Barnes Drill Co.

honing, lapping, finishing

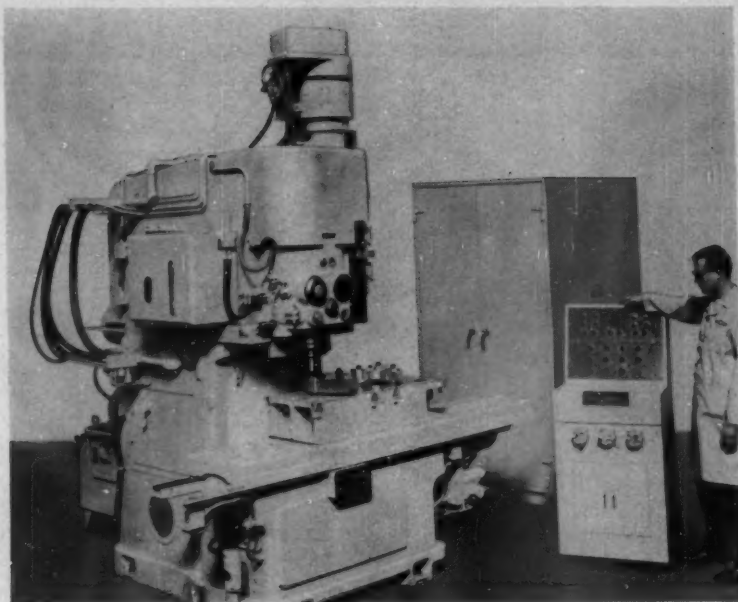
Designed to perform high-production honing operations on bores up to 3 inches in diameter and 3 inches long, this Nateco mechanical honing machine can be integrated into a transfer line. Rotational speeds of 200 to 800 rpm and reciprocation from 60 to 240 spm are fixed by pick-off gears. Stroke length is adjustable. Jes-Cal honing tools, employing an automatic method of size control, are used. National Automatic Tool Co., Inc.



Designed for high-production finishing of small parts, Taft-Peirce's No. 86 centerless plunge cut microstoning machine operates with a fully automatic work cycle. The machine microstones parts by turning them between two rotating rolls, where they are kept in contact with a rapidly oscillating abrasive stone. This operation removes the amorphous surface layer left by the cutting pressures and temperatures of previous machining operations and corrects errors such as chatter marks, feed-spirals and out-of-roundness. Parts up to 2 inches long and from $\frac{1}{8}$ to $1\frac{1}{2}$ inches in diameter can be finished.

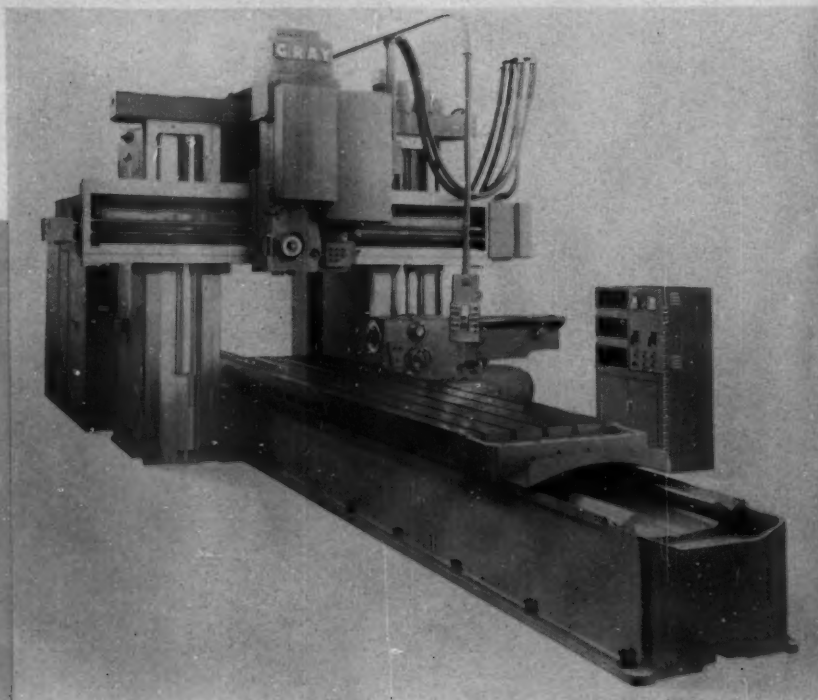
milling

With the advent of numerical control, improvements in tracer control and the development of better cutters, milling machine productivity has more than tripled during the past several years.

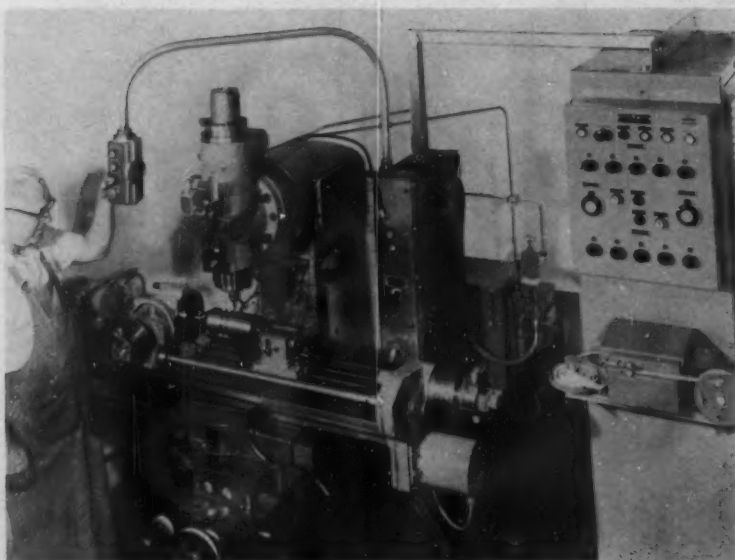


Capable of milling intricate contours and variable depths of pockets, Cincinnati Milling Machine Co.'s 16-inch vertical mill is equipped with 3-axis numerical control. On this machine a roughly shaped block of steel can be milled to circular, elliptical and flat surfaces on its exterior profile and an interior profiled pocket of varying depth. The part is then turned over and a mirror or reverse image milled on the other side with no change of tape. The control system's parabolic interpolation of the data fits a curve to a curve rather than trying to approximate a curve with a large number of straight lines.

Equipped with a 4 x 16-ft table, 10-inch quill, 50-hp nonswiveling rail head and a 25-hp boring type side head, this planer type milling machine has spindle speeds to 500 rpm. Power rails can be leveled quickly; out-of-level is determined from an indicator and corrected by pushbutton controls. The machine, built by The G. A. Gray Co., can be numerically controlled.

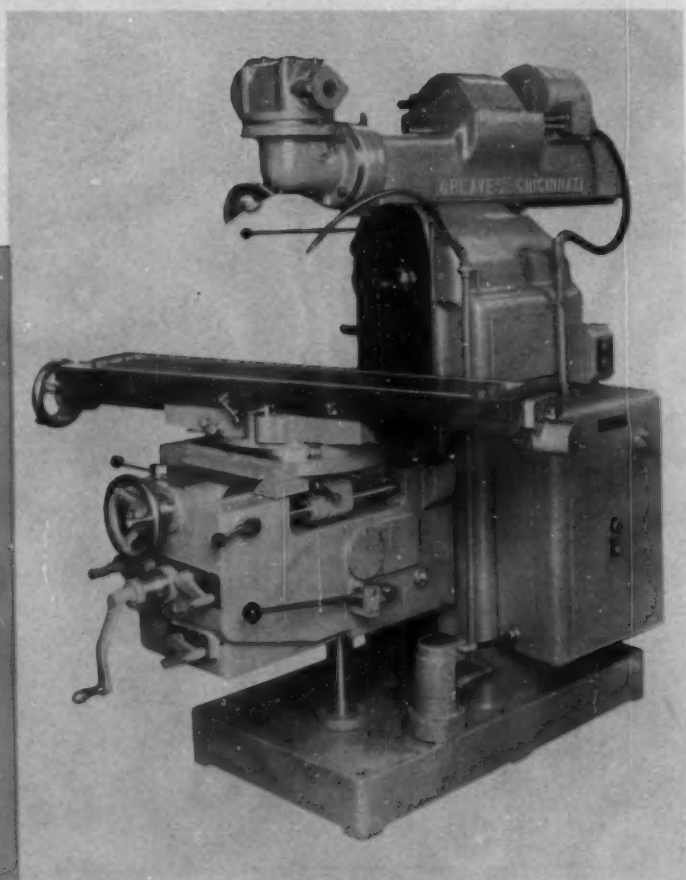


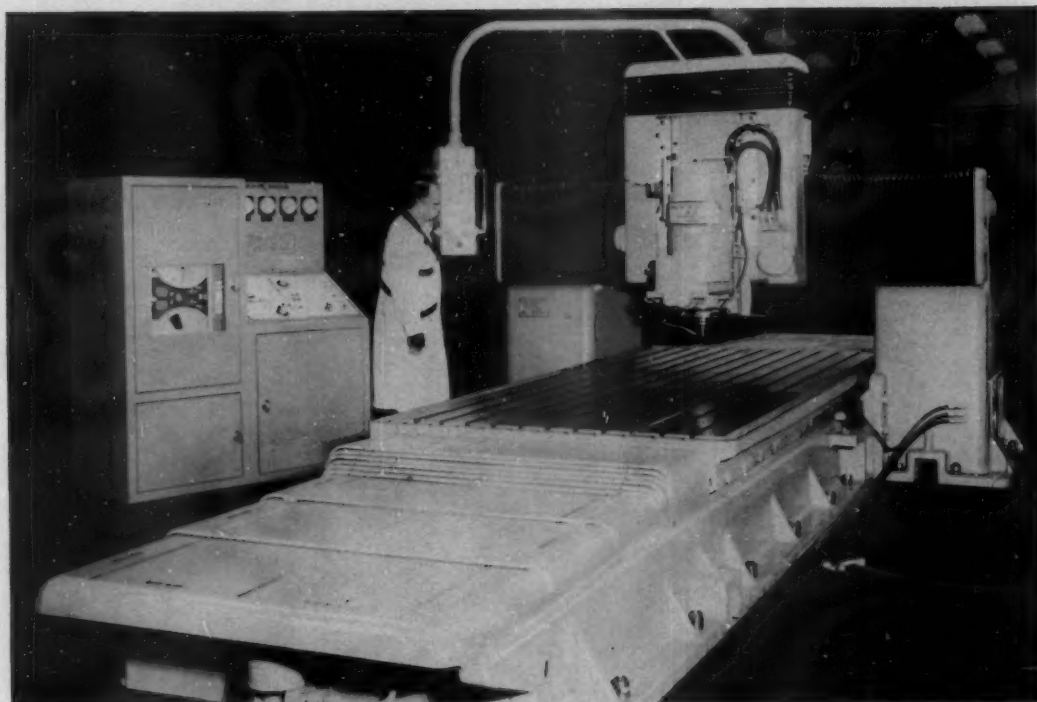
milling



"Numerical," tape-controlled cam milling machine developed by Brown & Sharpe, is a modified version of their No. 2 vertical mill with universal positioning control. Capable of machining unusual contours, including cylindrical, conical and flat-surface master cams, it can operate using a fully automatic cycle controlled by 1-inch, 8-channel tapes. Data for the tapes are calculated on small computers such as IBM 610 Autopoint, Bendix GP 15 or Autonetic's Recomp II.

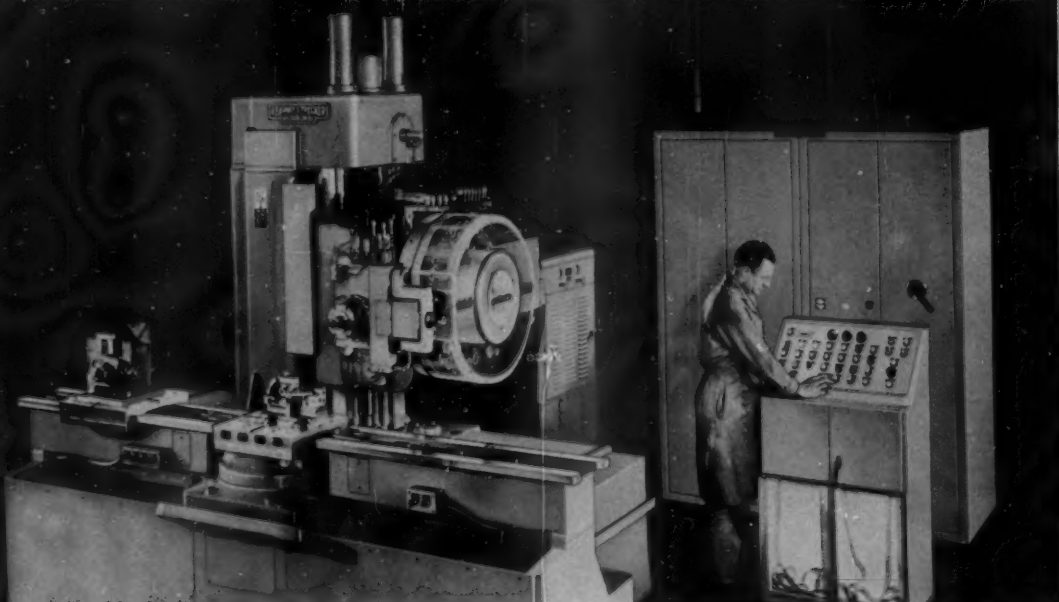
Greaves 2XH universal milling machine has a table drive that is independent of spindle drive; speed-feed combinations for every class of work, including superalloys; one-shot lubrication plunger to lubricate table, saddle and knee; and scraped ways. A toolmaker's overarm with two graduated heads permits the machine to be used for vertical or horizontal work. The Greaves Machine Tool Co.





This tape controlled milling and profiling machine, with a table work surface of 60 x 144 inches, is of the traveling table, vertical spindle, bridge type design. The machine has antibacklash recirculating

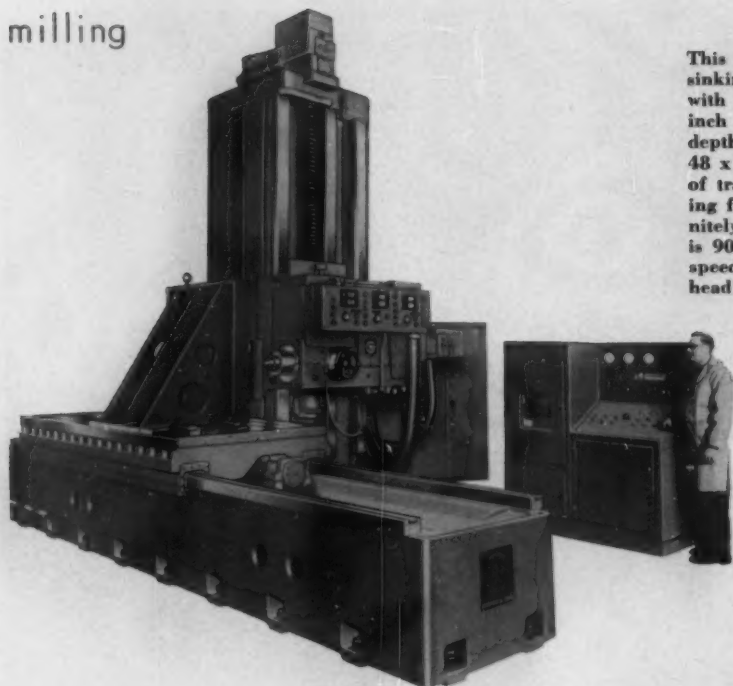
ball bearing screws on each axis; continuously variable spindle speeds from 15 to 6000 rpm; and optical viewers and precision scales. Magnetic or punched tape systems can be used. Ekstrom, Carlson & Co.



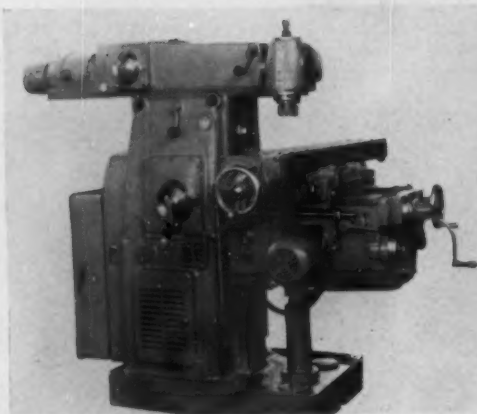
Model II Milwaukee-matic is completely numerically controlled. This "machining center" will mill, drill, bore, tap, select and change its own tools and feeds and speeds, and transfer the workpiece. All machine motions are powered by a 30-hp hydraulic unit.

Speed ranges are from 0-4000 rpm in increments of 10 rpm. The feed range is from 2-99 imp in increments of 2 ipm, with a rapid traverse rate of 200 ipm. The three axes of motion have ranges of 24, 20 and 16 inches. Kearney & Trecker.

milling

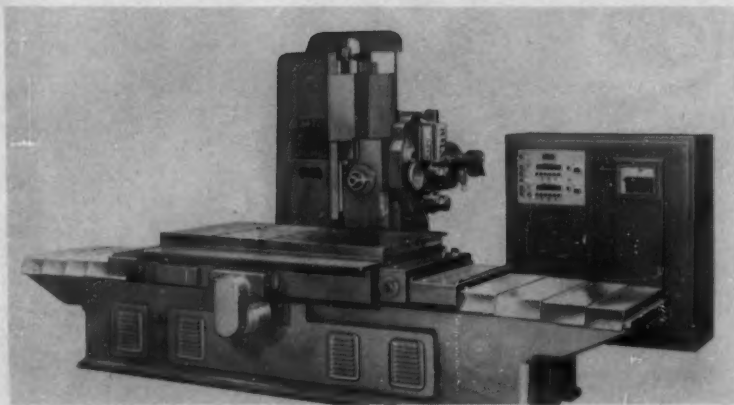


This Giddings & Lewis horizontal die sinking and contour milling machine with magnetic tape control has a 72-inch vertical travel and an 18-inch depth travel to the headstock. The 48 x 98-inch worktable has 84 inches of travel. With tape control the milling feed ranges are 0 to 60 ipm, infinitely variable. The rapid traverse rate is 90 ipm. Equipped with 32 spindle speeds from 8½ to 1800 rpm, the head has a 7½-inch-diam quill.



Capable of angular, multiple, surface, vertical and horizontal milling, this machine has a motorized ram with vertical and/or universal head attachments. The ram is driven by a 3-hp motor with controls at the front and rear of the machine. Electrical controls are interlocked so that the head and machine spindle can be moved together or independently. A dial selector speed change mechanism has eight changes. The Kempamith Machine Co.

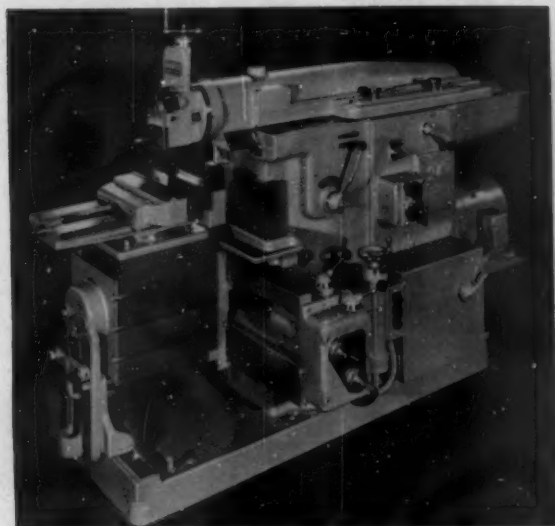
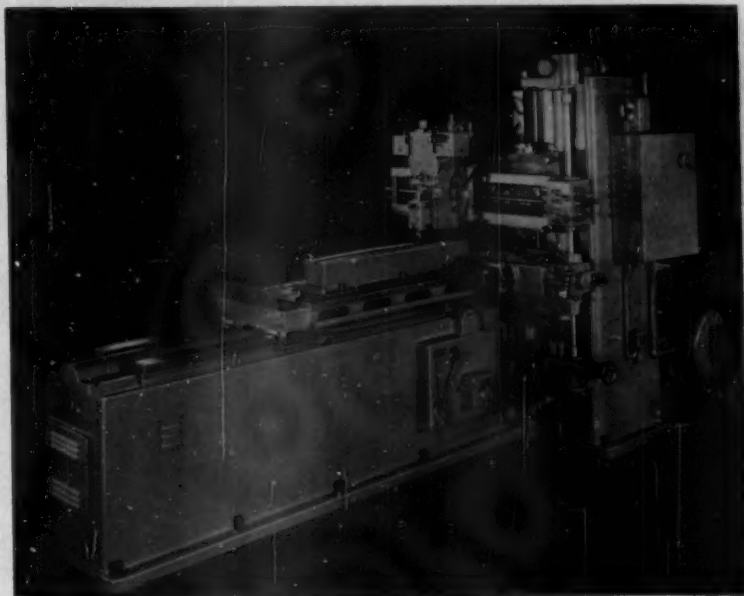
Tape-controlled by a point-to-point system for automatic measuring, positioning and cycling complete parts programs, DeVlieg's No. 3H072 jig mill comes in spindle sizes ranging from 3 to 5 inches. The selection of spindle speeds and feeds, control of spindle depth of feed, automatic spindle rapid traverse, feed and retraction, and automatic advance to new hole locations can all be programmed into the 1-inch, 8-channel standard punch tape used by the control system.



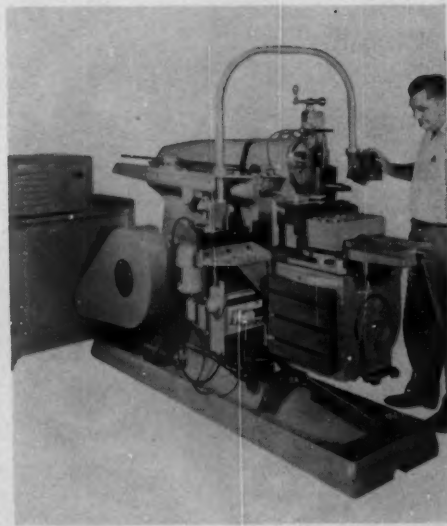
planing and shaping

Faster metalcutting, electronic duplicating and improved accuracy are important developments in shaping. Planers are faster and more versatile.

Equipped with a 15-hp hydraulic table drive, Rockford's No. 72 hydraulic open side shaper has a newly designed duplicator incorporated in the machine bed. The machine's speed ranges are 10 to 100 fpm in the low cutting range and 100 to 200 fpm in the high cutting range. The maximum return speed is 200 fpm. Used with rail mounted templates only, the compact duplicator head is interchangeable with the standard rail head. The duplicator, driven by the machine's 20-hp main drive motor, is equipped with a reset timer, automatic head lift and ratchet lock.



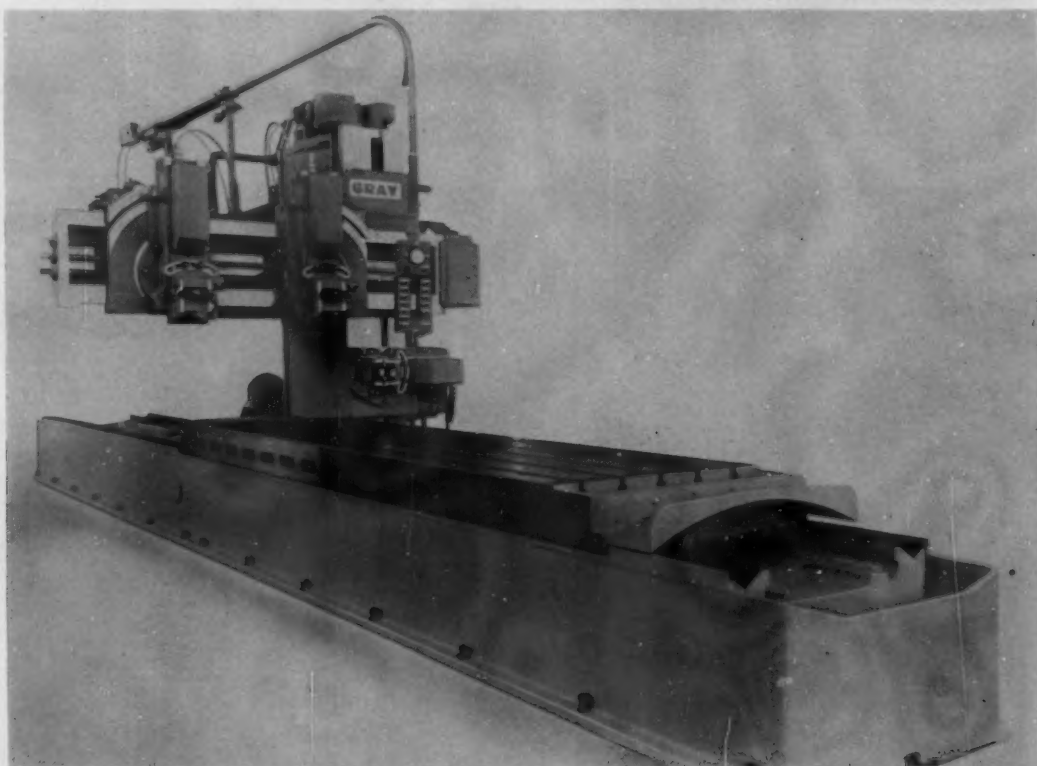
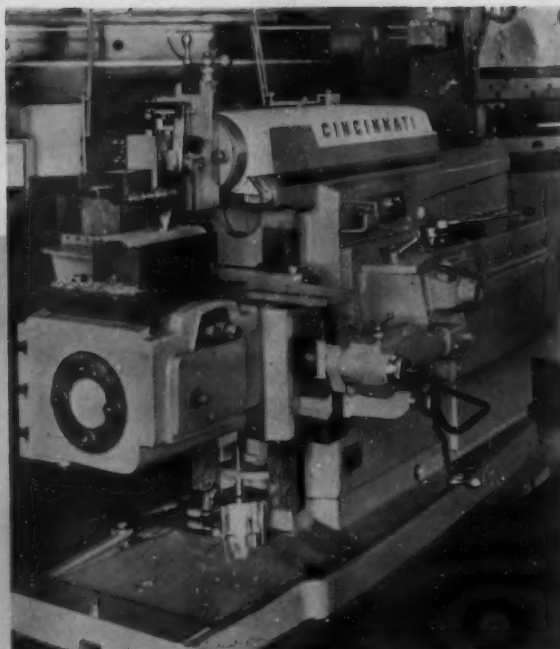
This 24-inch shaper has hydraulic drive, infinitely variable constant cutting speeds and feeds, independent return speeds and easily adjustable ram stroke settings. Limit switches on the ends of the crossrail prevent the operator from traversing the saddle into the crossrail end and jamming the screw nut. The machine is equipped with adjustable double nuts on the tool slide and the saddle crossfeed drive. Hardened and ground ways are used on top of the crossrail and on the ram. Rockford Machine Tool Corp.



Controlling vertical table travel while the table itself is feeding horizontally, an electronic duplicating attachment adapts this shaper for accurate contouring. The stylus follows the contour of the master template, with the table automatically and electronically synchronized. The shaper, made by Smith & Mills Shaper Div. of the Nebel Machine Tool Corp., has a maximum stroke of from 17 to 37 inches.

planing and shaping

Equipped with hydraulic tracer control and a universal table, the Cincinnati Shaper Co.'s 16-inch heavy-duty shaper has a 17-inch maximum stroke. Cutting speeds range from 12 to 157 spm. Other features of the machine include: power rapid traverse; automatic force feed lubrication with 50-psi oil pressure; a brushless electromagnetic clutch and brake; an internal transmission running in oil; direct reading controls; and an automatic tool lifter.

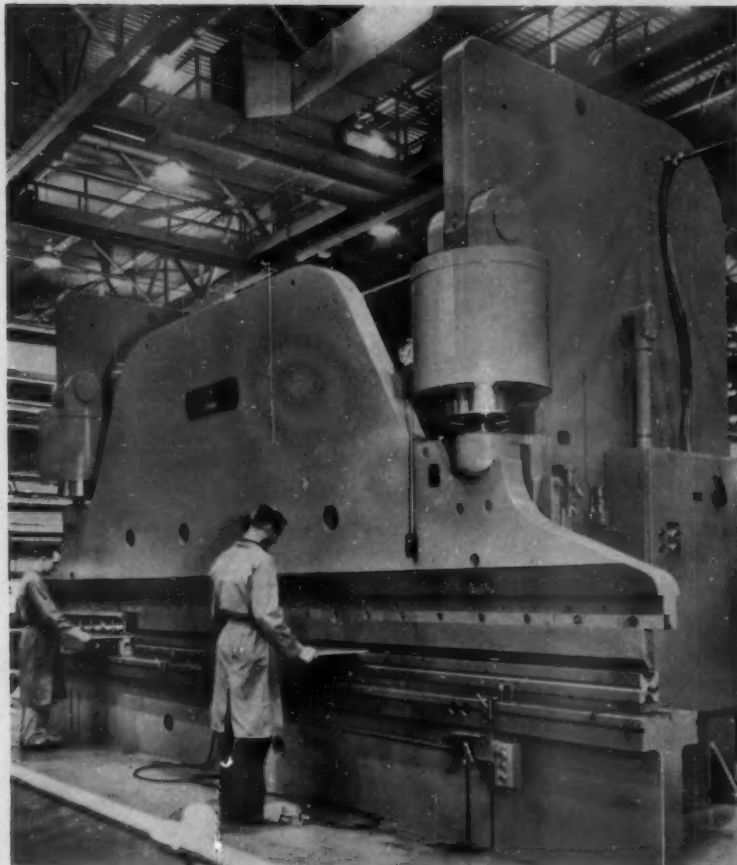


Universal planer with table speeds adjustable up to 300 fpm makes it possible to finish-plane simultaneously with double cut roughing. This combination results in precision cuts at high speed, without a tool change. Designed by the G. A. Gray Co. to use conventional tools interchangeable with other planers,

the 100,000-lb machine can be transformed by lever control to a double-cutting high-production planer. Complete pendant control, including table movement, selection of feeds, selection of direction and rapid traverse, reduces machine time, tool-setting time and machine-handling time to a minimum.

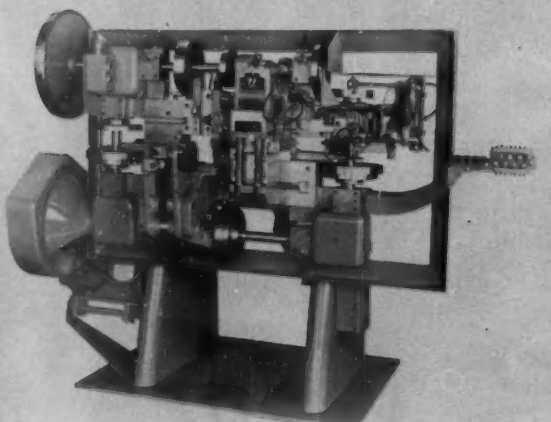
pressworking

Modern presses are characterized by more power, faster cycle times and virtually maintenance-free operation, due to improved over-all design and improved mechanical, electrical and hydraulic components.



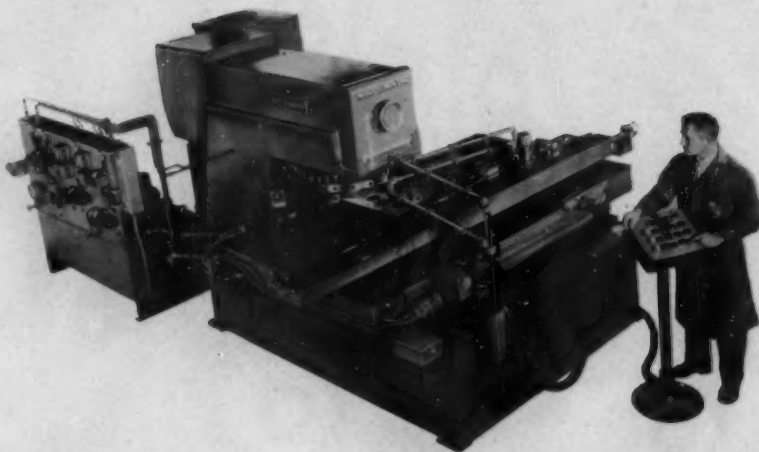
The Cincinnati Shaper Co.'s No. 750H hydraulic press brake has a bending capacity of $\frac{3}{4}$ -inch x 14-ft. mild steel over a 7-inch die opening. The machine has a 24-ft over-all die surface, a 16-inch bed top width, an 18-inch throat, a 12-inch stroke and a 24-inch extension on each end of the bed and ram. The ram has speeds of 85, 53 and 21 ipm; return speeds are 39 and 63 ipm. The taper adjustment has a micrometer register to record the amount of tilt to 0.001 inch.

Operable at any desired angle from a horizontal 0 deg position to 90 deg, this new RWI-1 ribbon metal and wire stock forming machine accepts feed lengths up to 8½ inches. It can turn out 75-300 parts per min at normal speed with a variable speed drive and by incorporating high-speed cams and short feed can produce up to 400 parts per min. The Baird Machine Co.

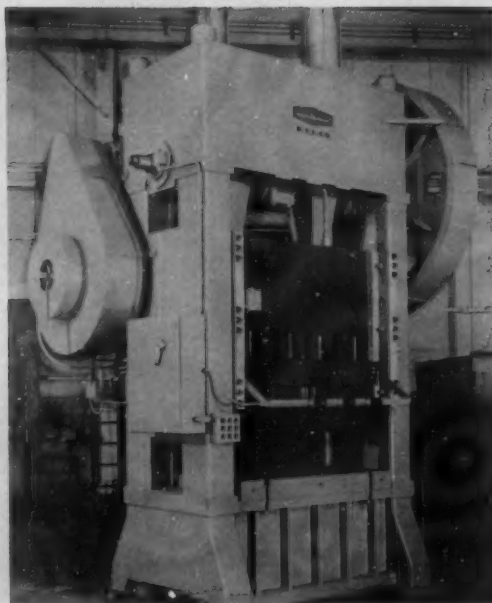


pressworking

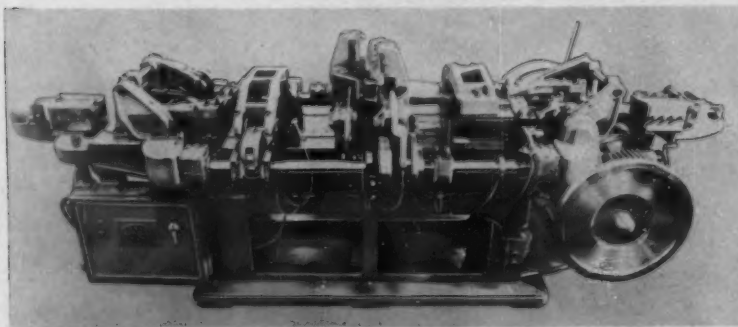
This Wiedemann turret punch press with numerical positioning control automatically locates and pierces holes at the rate of 60 per minute, including tool changing. Operating at 200 crankshaft spm, the 15-ton machine can pierce a 3½-inch-diam hole in 14 gage mild steel. Sheets up to 30 inches x 48 inches x 3/16 inch can be positioned and pierced in a single handling. The table moves at the rate of 500 ipm. The turrets carry 26 to 32 punches and dies.



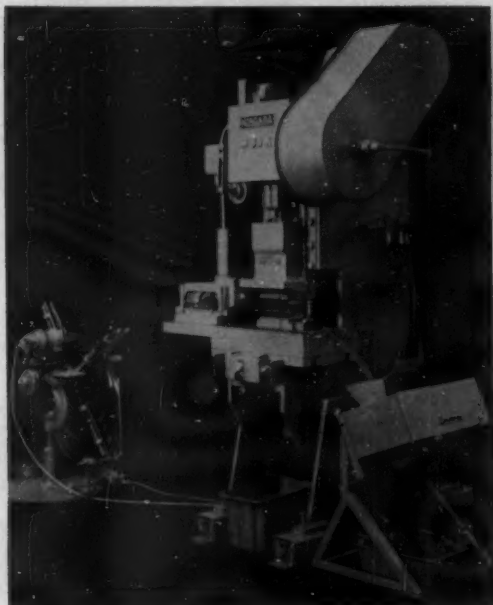
This E. W. Bliss piercing and positioning machine can locate holes accurately within 0.001 inch and can be set up in one minute. It consists of a positioning table and a bench press. It can pierce holes in sheet metal or in fiber parts such as printed circuits.



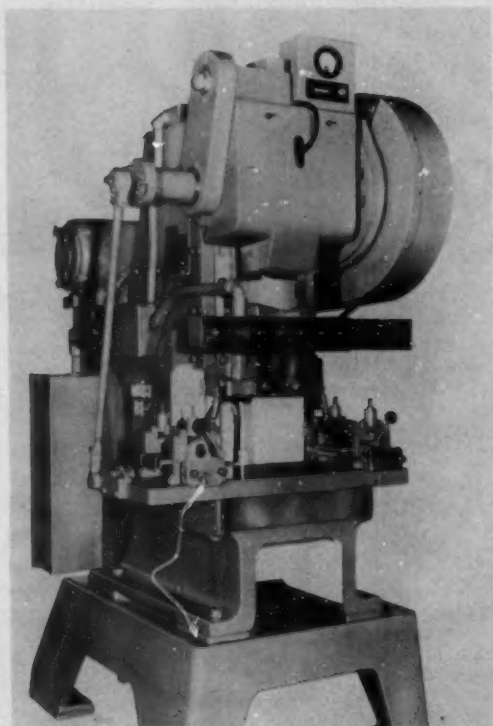
This No. S2-300-60-48 straight-side, double-crank, fabricated steel press has a 300-ton capacity and a 60 x 48-inch bed area. Made by Johnson Machine and Press Corp., the press has an air friction disk clutch and an air actuated, spring brake.



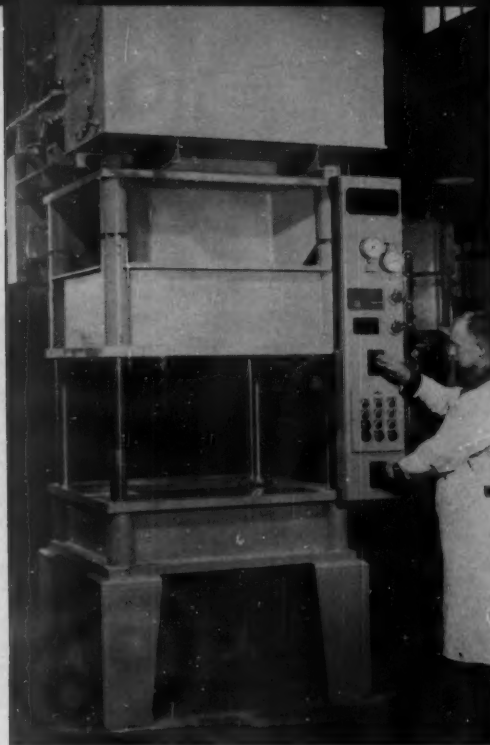
U. S. Tool Co.'s No. MS-36D duplex multislid machine is a double-ended unit for the production of formed metal stampings and assemblies. Material up to 3 inches in width can be fed in at both ends of the machine, one strip feeding left to right and the other right to left. Feeding length is adjustable up to 6 inches. The machine has a 25-ton capacity at each end.



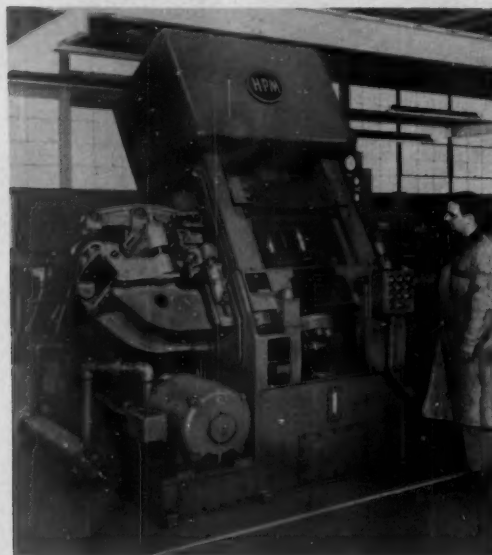
Fully automatic coil-fed OBI press operates at variable speeds up to 1000 spm to produce parts at a million-per-day rate. Niagara Machine & Tool Works.



Variable speeds of Minster's No. B1-22 flywheel gap press range from 400 to 800 spm. Equipped with a high-speed balanced crankshaft, snap-in bearings, flame-hardened gibs and a light alloy metal slide, the machine has a fixed base design and a boxed frame top. The controls are in a shock-mounted cabinet. Various feeds, controls and drives can be supplied.



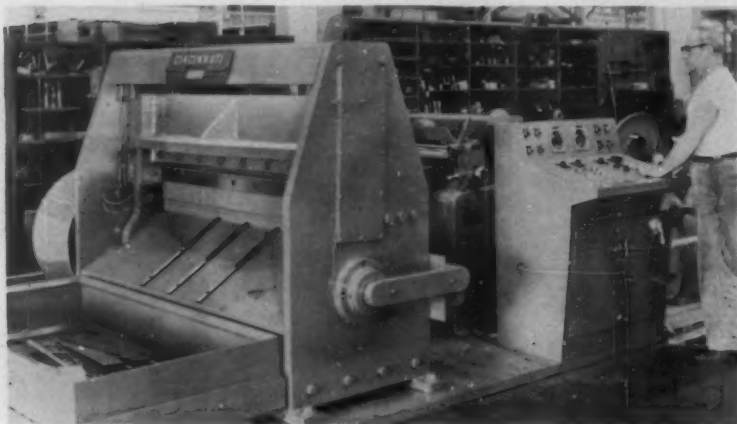
This 20-ton 4-column downstroke press is self-contained and pushbutton operated. Designed for trimming die cast flash, plastics and rubber, the machine can be equipped with a cushion for metal draw work. The press, available in 10 to 50-ton capacities, is adaptable for general purpose use. K. R. Wilson, Inc.



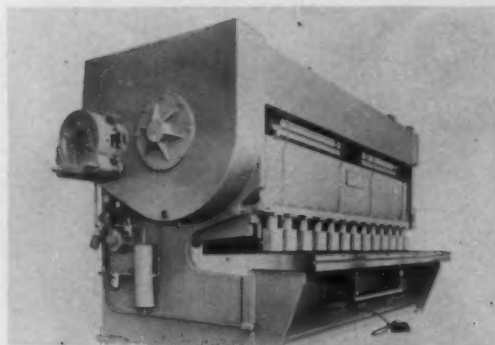
Equipped with a special die, this fully hydraulic triple-action blanking press produces smooth edge parts at speeds up to 120 spm without any shaving operation. The burrs are greatly reduced and parts such as cams can be used in assembly direct from the press. Built by The Hydraulic Press Mfg. Co., the unit accepts coil steel using an automatic roll feed, or strip stock. The metal thickness and type of metal can be changed without press adjustment.

shearing

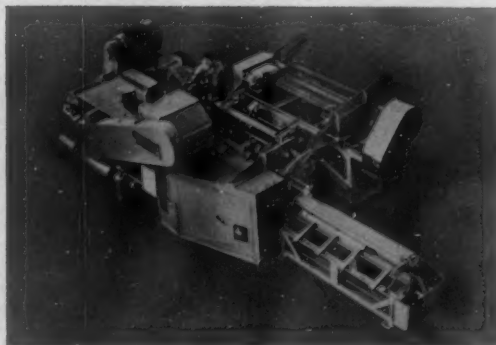
Today's shears, large and small, have greater capacity, improved versatility and operate at higher speeds than was the case only a few years ago.



Operating at 200 spm, this under-drive, downcut shear has a capacity of 10-gage x 5-ft mild steel. The 62-inch-high machine, built by the Cincinnati Shaper Co., is designed for and adaptable to cutoff lines. It has a maximum of 125 cuts per minute, a 36-inch table height, an inclined ram, a springbar type hold-down, a combination air clutch and brake and a double rake upper knife.



Equipped with an air-operated clutch and brake, spring hold-downs, a front-operated back gage and a Micro-set knife adjustment with a front control, Steelweld's No. 8D-12 mechanical shear is designed for slitting and notching. It has a 300-ton capacity.

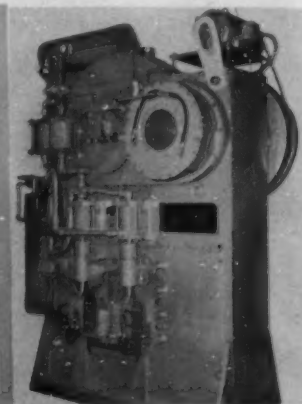


No. 500 bar-billet shear is designed with complete automation, including automatic hold-down, automatic length gage and automatic outboard support. Manufactured by The Hill Acme Co., the machine has a full capacity of 4-inch-diam mild steel bars.



Designed for small shearing jobs and repetitive operations such as notching, trimming and blanking, this 24-inch speed shear has a $\frac{1}{2}$ x 24-inch capacity. The machine, built by Lodge & Shipley Co., is equipped with a front-operated back gage and a light gage for cutting to a scribed line. This speeds operation.

Designed to function continuously at full capacity on any shearable material, Buffalo Forge Co.'s 78 x 52 x 114-inch No. 400 shear operates at speeds up to 60 spm. Ram tonnage is 400 tons and the machine stroke is 2 inches. The shear handles 4-inch-square billets, 4½-inch-diam rounds and 12 x 2-inch flat bars.



thread rolling

High-quality threads, high output are the outstanding characteristics of these machines, which have automatic features.

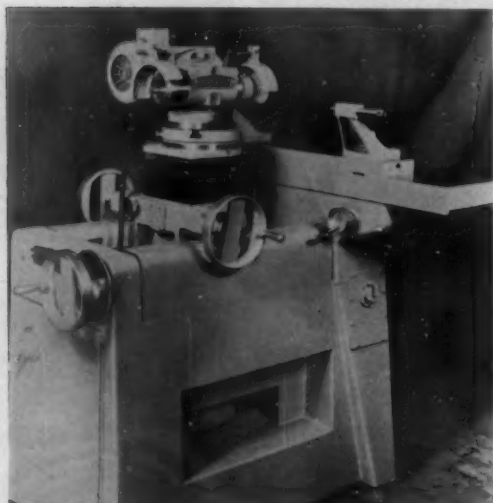
Automatic through-feed rolling of rod-length stock is possible with this thread rolling machine, which has a 2-inch maximum infeed rolling capacity and 1-inch maximum through-feed rolling capacity. Stock is loaded by the operator and started between the thread rolls by an air-operated pusher mechanism. Finished stock is automatically transferred to a storage rack. Landis Machine Co.



Designed for 5-inch-diam infeed capacity and adaptable to high-speed production of parts up to 1-inch diam, Reed's No. B150 thread rolling machine has two cylindrical dies. The machine is equipped with a hydraulic servo mechanism which controls die penetration rates. A completely detachable unit, the hydraulic system has an overload control to protect the dies from damage should oversize blanks accidentally be rolled. The 12-inch die gap is adjustable to accept various die face combinations for double-end studs up to 11 inches in length.

toolmaking

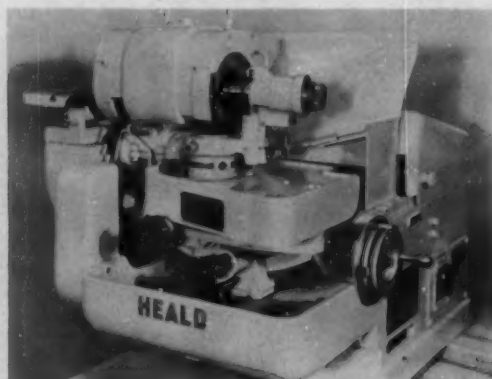
Special machines for sharpening tools have been developed to give higher standards of accuracy, speed and ease of use.



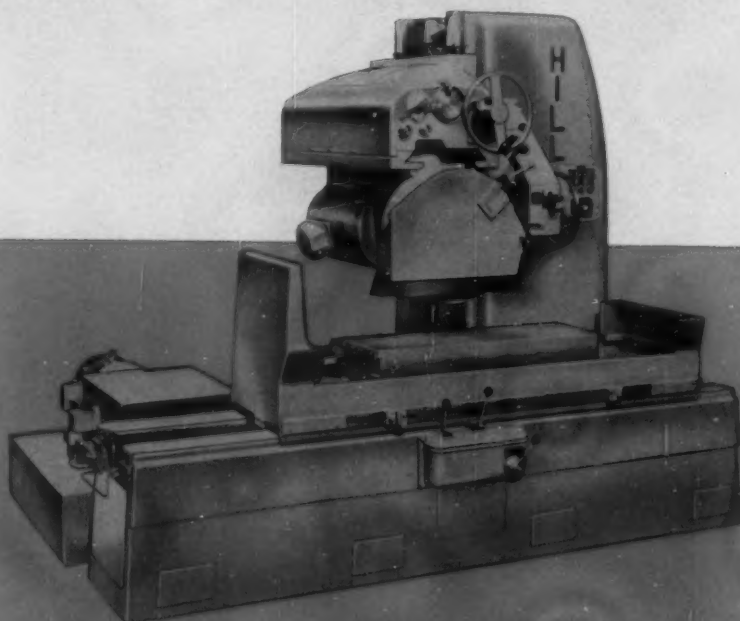
Clearance angles are read directly from a scale on the tilting wheelhead of this No. 200 cutter and grinder. With the tilting feature, the tooth rest remains set on the centerline of the cutter for practically all grinding jobs. This eliminates having to set the tooth rest at different heights for clearance angles setting on each job. Eccentric mounting of the wheelhead extends the capacity of the machine in many special jobs where maximum swing is required. Norton Co.



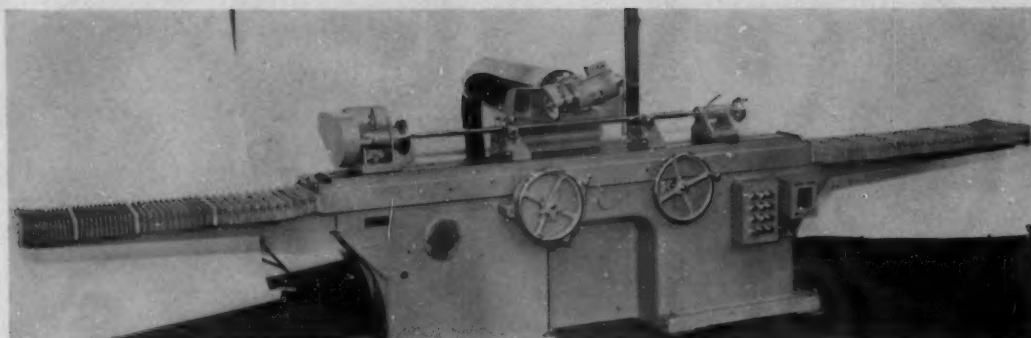
This heavy-duty No. 21 bench model drill pointer has increased clearance at the center of the drill and a $3/32$ to $1/2$ -inch capacity. Oliver Instrument Co.



Heald Model 4 tool sharpener permits either elliptical or true radius tip grinding of carbide or high-speed steel cutting tools. Tool reciprocation is completely automatic and setup and operation are simple.



For grinding hardened steel shear blades, The Hill Acme Co. has developed a 12 x 42-inch horizontal spindle grinder. The machine uses a magnetic chuck and will hold tolerances within 0.0002 inch.



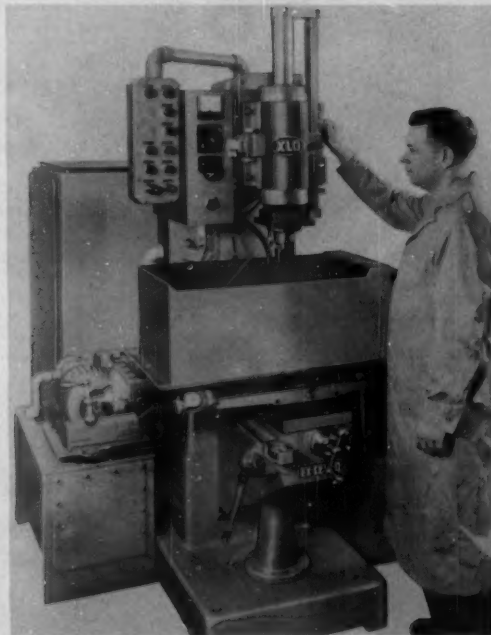
Capable of sharpening either internal or surface broaches, LaPointe's universal broach sharpener is equipped with a microfeed attachment for minimum stock removal when sharpening. A three-speed frequency changer is used in connection with the spindle

motor to obtain spindle speeds up to 10,800 rpm. The 72-inch machine has an air spindle for backing off surface broaches, a dust collector, a spray mist coolant system, a swivel chuck and a motorized headstock and tailstock with an index attachment.

Sheffield's No. 200-B2 ultrasonic machine tool has a machining area ranging from 1/64 to 1/2 square inch with solid tool designs and an additional 1-inch capacity for shallow machining. Vertical tool adjustment is 2 inches. Equipped with an 8-inch-diam work chuck and a 200-w electronic generator and transducer, the machine has 8-inch longitudinal and 6-inch traverse table travel with handwheels graduated in 0.001 inch. An indicator light constantly monitors cutting conditions and a turning device in the generator automatically senses and compensates for tool wear. Fed into the workpiece by means of gravity or planetary feed, the tool can be controlled to close tolerances throughout the entire 2-inch range. The tool is radially adjustable through 360 deg. The machine has both toolroom and production applications.



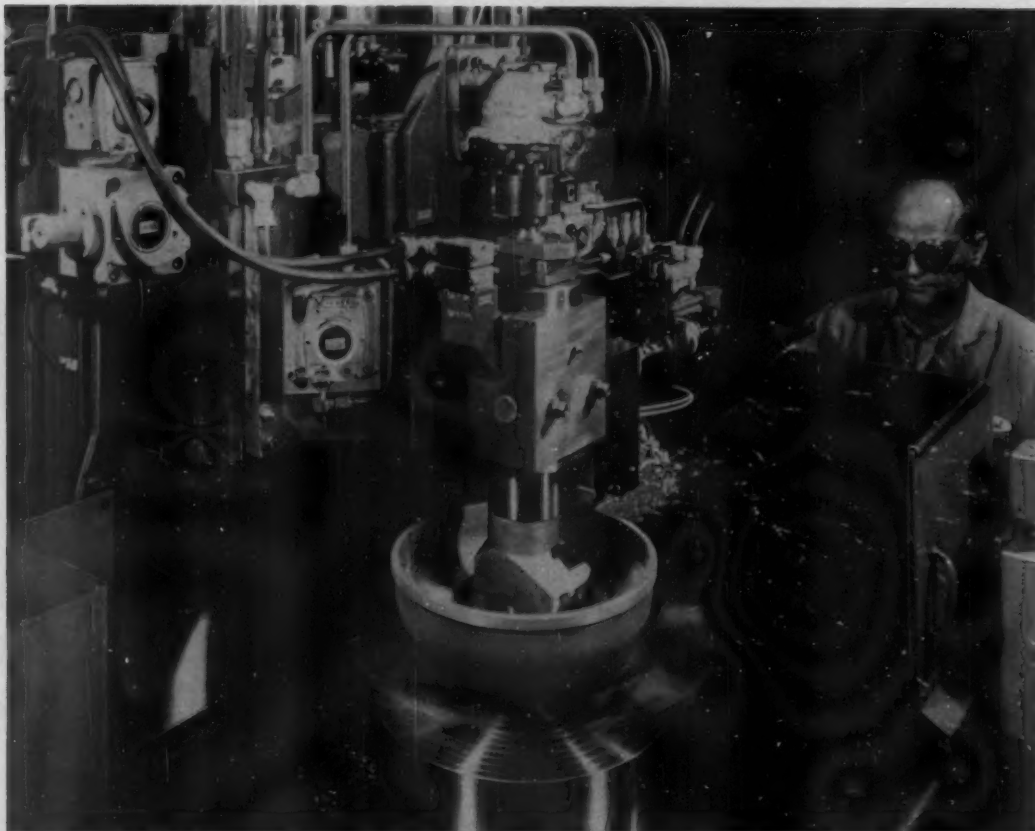
Spiropoint drill sharpener is used to impart spiral-point geometry to twist drills. This machine grinds drills from 0.040 inch to 1 inch in diameter. Production is one drill per minute and provision is made for easy variation of point and clearance angles. The machine is made by Cincinnati Lathe and Tool Co.



Ex-Cell-O's No. 244 vertical electrospark machine uses relatively soft tool materials to cut intricate shapes in carbides and similar materials. When the tool and work are brought close in a dielectric bath, 40,000 electrical impulses per second remove particles of the work, forming an inverse image of the tool.

turning

Improved tracer controls, numerical controls, higher feeds and speeds—these are some of the developments that are doubling lathe productivity.

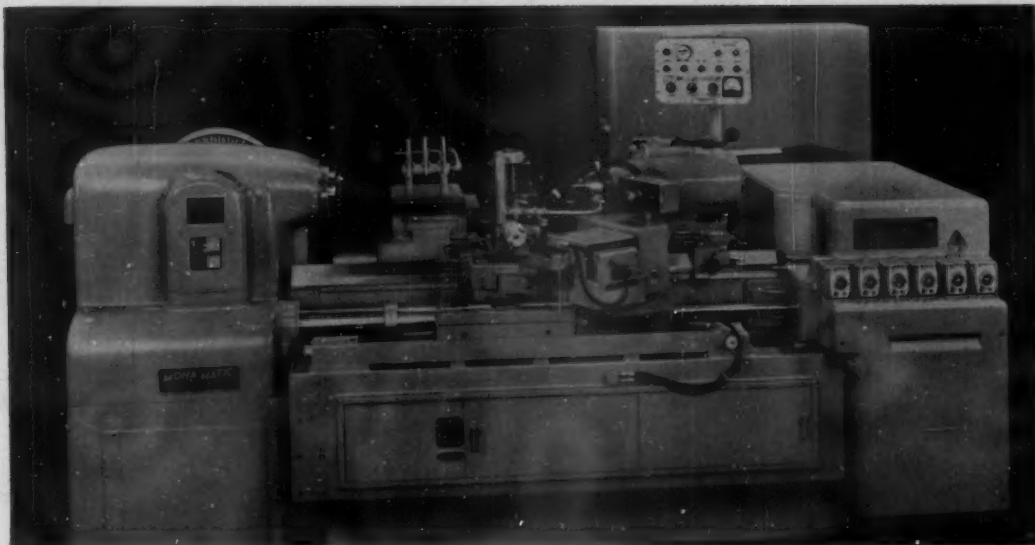


Shown machining a motor end bell, Motch and Merryweather's No. 1-V single spindle vertical turner has an 18-inch-diam maximum part swing and an eight-inch spindle nose. To change the machine's chip removal performance, slides on which the cutting tools are

mounted can be repositioned or adjustments can be made in the control system. The machine has up to 20-hp, 1800-rpm spindle drive. The 12 x 19-inch vertical turning slide has a 3-inch hydraulic cylinder and 8-inch stroke. The cross slide is 7 x 10 inches.

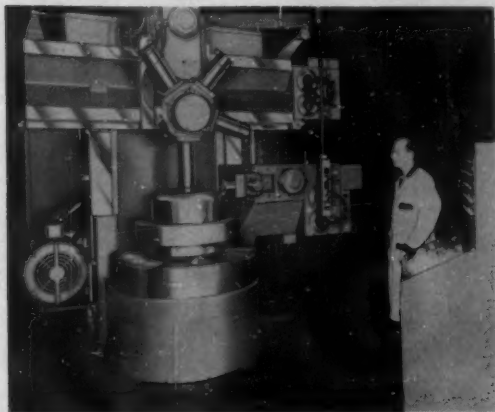
Continuous-path magnetic tape control enables Gisholt's No. 101 turret lathe to handle a wide range of work with minimum tooling and tool change-over. The simple tape preparation required by the system cuts lead time requirements on short-run work. Tools on the hex turret and cross slide carriages are capable of performing contouring operations.



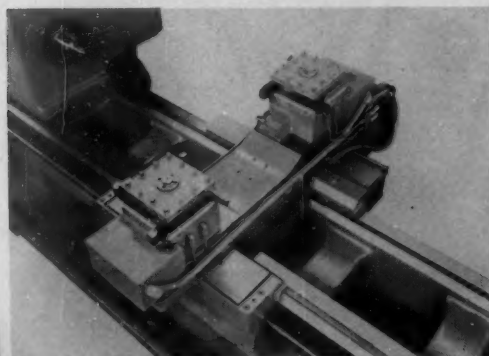


An air-gage tracer system controls the hydraulically powered tool slide on this Model 21 heavy duty lathe. When furnished with a four-cut cycle, there is no reasonable limitation on the amount of stock removal. Accuracy of template shape is reproduced within

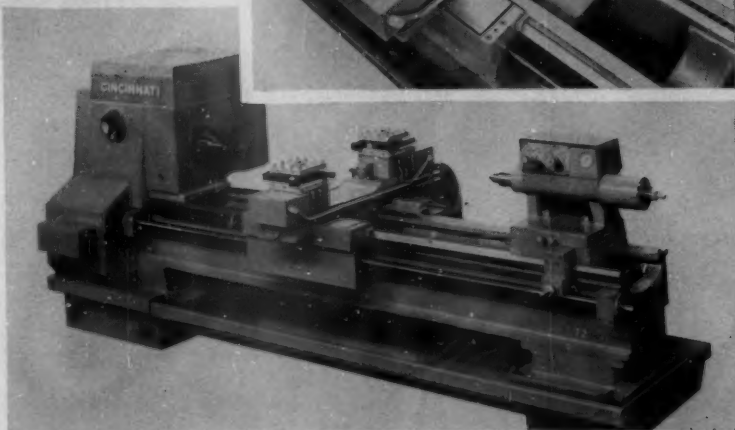
± 0.001 inch. Feed rates are infinitely variable from 1 to 40 ipm. Carriage traverse is 200 ipm. Facing and forming slide feed rate is $\frac{1}{2}$ to 20 ipm. Traverse is at 90 ipm. Top speed is 2760 rpm with a 30-hp drive motor. The Monarch Machine Tool Co.



This Giddings & Lewis 42-inch vertical turret lathe has a five-position turret rail head and a right-hand, four-position turret side head. Tape control automatically positions the nine different tools carried by the two turrets. Speeds are from 6 to 320 rpm and feeds are from 0.0007 to 0.576 ipm.

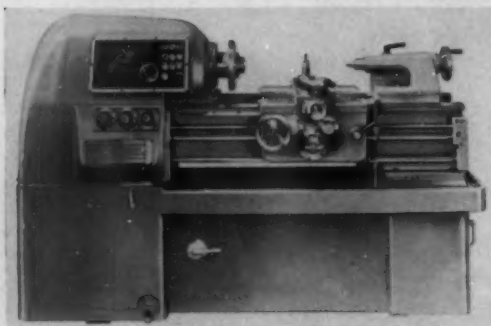
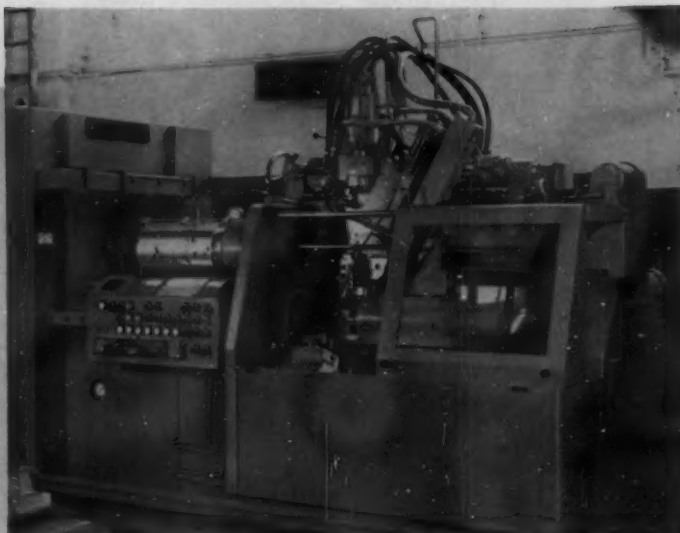


All machining and operating functions of this Cincinnati numerically controlled lathe are fully automatic. The 15-hp lathe, which is intended for turning stepped-shaft work, will also perform boring and facing operations. Necks, chamfers and other forms are cut with form tools. Two four-tool turrets are available—one on the front and one on the rear of the cross slide. (See inset) Selection of any one of the eight tools is automatic, by commands from the tape. Cincinnati Lathe and Tool Co.

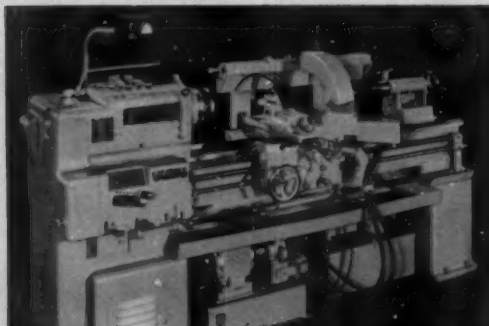


turning

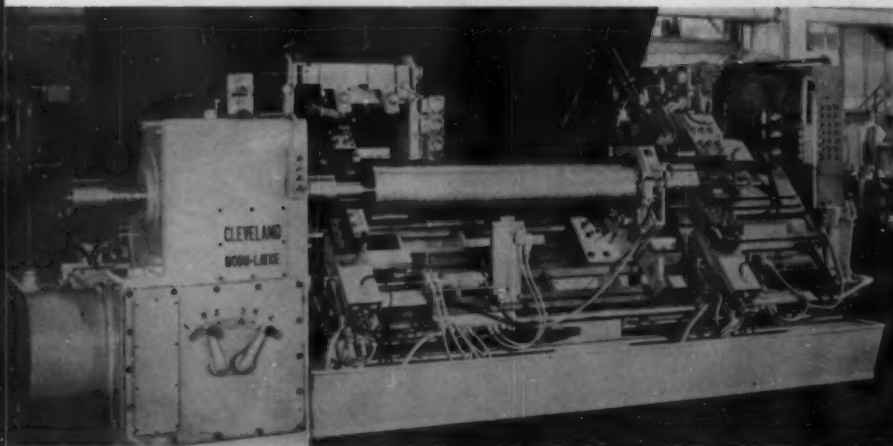
Jones & Lamson's No. 30 automatic tracing lathe offers up to 32 spindle speeds, with automatic speed and feed change during a cut. Available for addition to the base machine, a bridge-bed design, are a variety of components: a 6-inch hydraulic ram tailstock mounted on the lower bed for between centers work; multiple tooling applied to a rear forming slide; a rear facing, forming and turning slide; and two bevel facing or necking slides.



Capable of infinitely variable spindle speeds from 43 to 3500 rpm, Nebel's Micro-Turn lathe has a coaxial headstock designed around a single shaft surrounded by a floating type ring and planetary gear arrangement. At speeds up to 400 rpm, a back gear unit on the headstock gives maximum power for cuts. At speeds above 400 rpm, the coaxial sections of the headstock lock into one unit and the lathe operates from the main drive to the spindle without gearing.

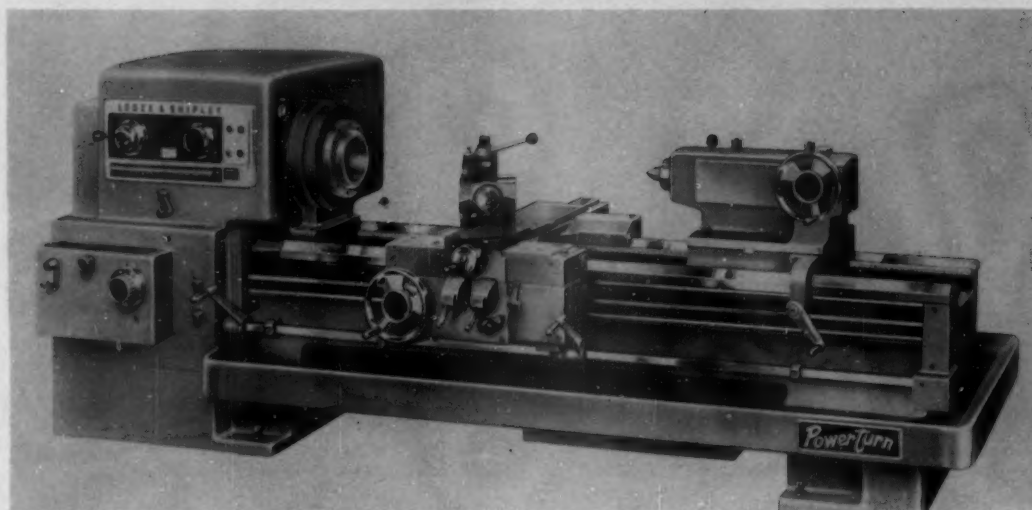


Powered by a 5 or 7½-hp motor, this 18-inch x 8-ft Rockford lathe has overhead tracer control, a flat master carrier and a duplicator slide with quick change-over to the standard slide and compound for manual turning. The basic machine is an all-g geared head engine lathe having 12 spindle speeds and 32 feed changes. Spindle speeds up to 1206 rpm are available. A hinged chuck guard prevents the coolant from being thrown away from the chuck.



This line of machine tools is designed on the building-block principle. The machines are built by combining standard components with any one of six standard headstocks and four standard beds. Turning type tools such as pedestal lathes, profilers, automatic chucks and automatic bar lathes, and threading lathes can be constructed. Cleveland Hobbing & Machine Co.

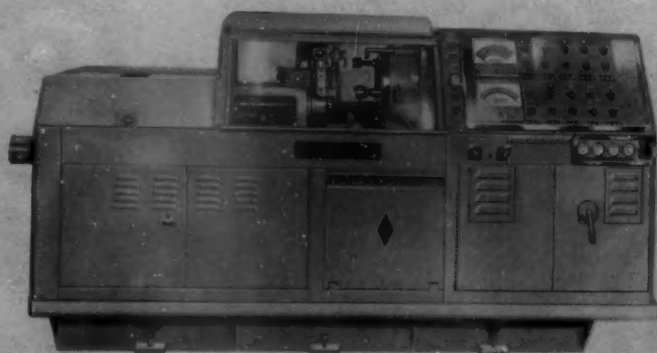
Spindle speeds range from 175 to 1800 rpm on this No. KU-10 multicycling automatic copying lathe. Built by the Cone Automatic Machine Co., the 10 x 35-inch machine can completely copy turn a part, including straight shoulders on either right side, left side or both sides. Two independent slides operating in either direction are applicable for front and rear tooling. The lathe is available with a 20, 30, 40 or 50-hp motor.



Lodge & Shipley's 20-inch No. 2516 Powerturn hollow spindle lathe has an 11½-inch hole through the

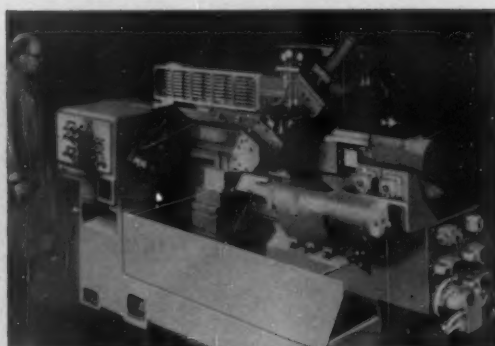
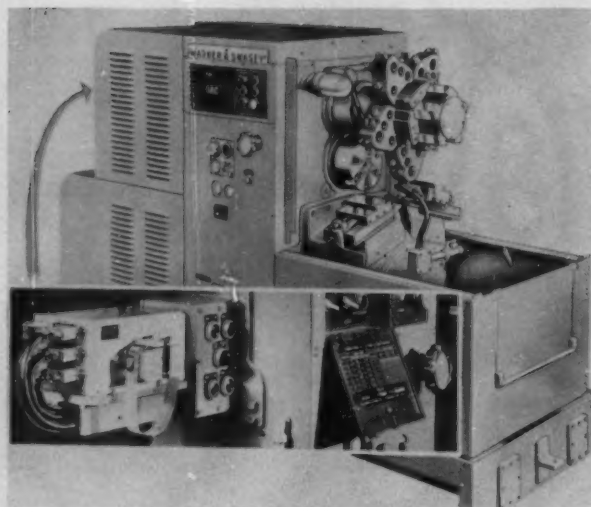
spindle. This hole allows the chucking of workpieces longer than the normal 120-inch center distance.

For each cycle this 1½-inch Model AB single-spindle automatic bar machine has 10 automatic infinitely variable spindle speeds. These speeds range from 40 to 3100 rpm. The 10 turret feeds are also infinitely variable and are dial controlled. Monitors indicate the spindle speed and feed for each of the turret positions. The Cleveland Automatic Machine Co.



turning

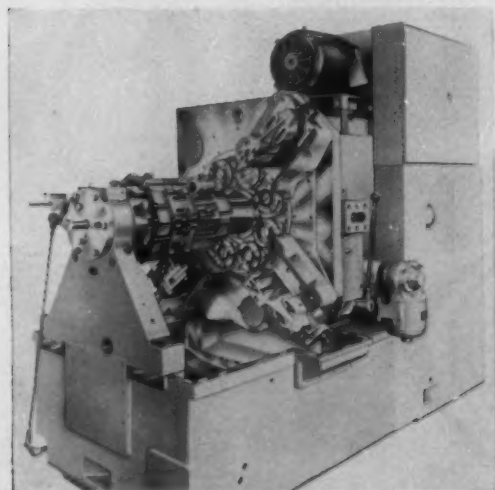
Warner & Swasey's new optional tape system controls all operating functions, including speed and feed changing, cross slide movements and lengths of cut, of their IAC single spindle automatic chucking machine. With the exception of high-low speed range selection and installation of the proper feed gears, the entire machining cycle can be preplanned on the tape. The operator can switch from tape programming to the standard electromechanical control system at any time. The tape control system permits special functions, such as drill relieving, without the installation of additional electrical equipment. Standard 1-inch, 8-channel tape is used. Compact units on the machine contain all tape handling and control equipment. The control system is electrical.



This Sundstrand No. 1425T multicycle tracer lathe removes stock in three roughing or semifinishing cuts and one finishing cut, all made in a single automatic cycle from one template. The roughing and finishing tools are mounted on a two-position indexing block. After the roughing tool takes up to three cuts automatically, the finishing tool indexes into position.



This double-duty machine has the sensitivity of an instrument lathe and the heavy construction that carbide cutting tools require. It holds tolerances within 0.0004 inch and takes a 1/4-inch cut at 0.020-inch feed in cold-rolled steel. The No. 1020S machine is manufactured by Rivett Lathe & Grinder, Inc. with both 20-inch and 30-inch centers.



Baird Machine Co. No. 78H 8-spindle automatic chucking machine has four new design features: universal cross slide, two longitudinal feeds, three individual spindle speeds and the ability to stop and position the spindles. Cross slides have independently controllable stroke and feed. Longitudinal tool slides are arranged for one or two cutting strokes and for separate operations such as milling, multiple drilling, tapping, broaching or other secondary operations. Spindle speeds range from 150 to 1750 rpm. Single or double indexing, automatic chucking, loading and unloading are possible.

PRECINCT 123
(See page 182)



NEWS

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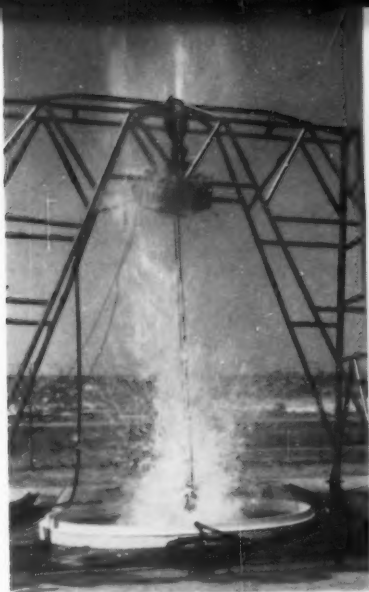
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HERF

highlights 1960-61 seminars

UNDERWATER LIGHTNING, shock treatments and gas chambers—as applied to metal forming—will be combined into an explosive debut for the ASTM's 1960-61 series of Creative Manufacturing seminars.

The two-day session on high energy rate forming, or HERF, for short, will be held at Chicago's Sheraton Towers Hotel on Oct. 11-12. A dozen experts will tell what they know about practical applications of the exotic and challenging metal-forming process that has evolved in recent years.

Most of the information that will be presented on HERF will be practical, some of it exclusive and heretofore proprietary. Speakers will represent such organizations as Battelle Memorial Institute, Convaire, Chance-Vought, General Electric, Westinghouse, Ford Motor Co., Nitroform and, tentatively, Ryan Aeronautics and Chrysler Missile Div.

Chicago was selected as the site for this first seminar of the Society's new educational season because of its widely diversified industrial interests, its central location and its world pre-eminence as a metal-forming center.

Papers will stress the production applications of high energy rate forming. The three major methods of HERF are explosive forming, wherein the shock wave from a chemical charge and subsequent hydraulic action form the material in its die; hydro-electric, generally called underwater lightning; and pneumatic-mechanical (also called "Dynapak" and impact forming), in which energy in the form of compressed dry nitrogen gas is released through a system of valves and applied to a semiconventional mechanical setup at an unconventional velocity.

In addition, the papers will consider safety and controls, die materials and die design, studies of HERF's effect on materials, and case studies of HERF showing its transition from research and development to a production tool.

The National Education Committee, which sponsors the Society's annual Creative Manufacturing seminars in cooperation with ASTM chapters in the cities where they are held, has announced that 10 two-day sessions have been slated for 1960-61.

In addition to the Chicago session on high energy rate forming, previewed above, the following seminars are scheduled:

- Nov. 8-9, Warwick Hotel, Philadelphia—**Standards and Standardization.** (Cosponsored with the American Standards Association.)
- Dec. 7-8, Dinkler Plaza, Atlanta, Ga.—**Metal Cutting.**
- Jan. 11-12, 1961, Chase-Park Plaza Hotel, St. Louis—**Quality Control.** (Cosponsored with the American Society for Quality Control.)
- Jan. 18-19, Statler Hilton Hotel, Dallas, Tex.—**Machining and Forming Space Age Metals.**
- Feb. 22-23, Bond Hotel, Hartford, Conn.—**Automation and Numerical Control.**
- March 2-3, Conrad Hilton Hotel, Chicago—**Dies and Die Design.**
- March 15-16, Statler Hilton Hotel, Detroit—**Plastic Tooling.** (Cosponsored with the Society of Plastics Engineers.)
- March 29-30, Sheraton Hotel, Philadelphia—**High Energy Rate Forming** (a repeat of the Chicago seminar).
- April 18-19, Statler Hilton Hotel, Cleveland—**Process Planning and Operations Research.**

New ideas and new techniques will be the emphasis in each seminar; none of them, according to Education Director Gilbert E. Seeley, are repeats of previous years' programs. The fundamental subject of metalcutting was selected for the Atlanta area because of the South's rapid industrialization and surging interest in metalworking.

The National Education Committee has lowered the fees this year for the two-day seminars. Cost will be \$45 for members, \$60 for nonmembers. The fee includes registration, seminar briefcase, luncheon and coffee break tickets, and a complete set of the seminar's technical papers.



Greg Touchman of the Cedarville, Ohio, High School Jets chapter explains to his 12-year-old sister Victoria the intricacies of his air liquefaction machine. The project won him the top award at the Jets Engineer-

ing Project Exposition at Michigan State University, and helped him capture the top title award of 1960 National Junior Engineer. Greg is pointing to the vacuum gage which he designed.

Chapters Urged to Help

THERE WAS A YOUNG MAN from Ohio with a more than passing interest in liquid air—and with a solid approach to life—who worked on a turkey farm after school and on week ends. With the \$200 he saved, plus matching funds from his father, plus matchless ingenuity, the young man propelled himself into the spotlight as the 1960 National Junior Engineer. . . .

With such youths as Gregor Touchman for inspiration, ASTME Executive Secretary Harry E. Conrad has lately been talking turkey to the Society's 160-odd senior chapters.

In a series of three letters addressed to the chapter-level leadership of ASTME, Conrad has advanced persuasive arguments for active chapter backing of Greg Touchman's dynamic young organization, the Jets—short for Junior Engineering Technical Society.

Talking up the Jets is talking turkey not only from the individual inspirational perspective but also in international terms. Jets offer one solution

to a serious problem facing this country in particular and the free world in general. The problem is the sharp decline since 1958 of college freshman engineering enrollments.

Here's why the story of Greg and his organization makes good sense.

From his part time job on the turkey farm near Cedarville, southwestern Ohio, Greg Touchman assiduously saved his money until he had enough, with a like amount from his engineer father, to pursue his "cryogenics" project in the Jets chapter at school.

In the fall of 1958 Greg started building his own air liquefier, a machine which cools a compressed gas until it reaches its liquefaction point. He patterned it after the first practical unit built by Prof. S. C. Collins of Massachusetts Institute of Technology. Besides obtaining a set of plans and some expert advice from Collins, Greg consulted other pioneers in the relatively new field of low-temperature science. He read books, kept notes. And in

the evening he started building the basic parts of the liquefier in his home workshop.

His father helped him on "two-man" operations, particularly where danger was present due to the high pressures involved. Many of the parts were fabricated in the basement shop, with a South Bend screw cutting lathe, a drill press and a good spread of hand tools. Greg begged and borrowed and bought other tools and materials, had some materials and equipment donated to him once his work really got rolling.

Since his initial outlay of \$175 of his own money, Greg has brought his total investment up to near \$500. According to his records, he spent over 600 hours on the liquefaction project up to July 1959, and hundreds of unrecorded hours since then.

By 1959 Greg had developed his apparatus to the point where it was workable and ready to exhibit at nearby science fairs. Regional recognition encouraged him to sophisticate his machine, and by this last spring he was ready for the all-important trek to the eighth annual Jets National Engineering Project Exposition at Michigan State University.

With his father's help again, 18-year-old Greg hauled his 600-pound machine from Cedarville to East Lansing in a borrowed pick-up truck.

Among 124 exhibits from enterprising young engineers from all over the country, Greg's air liquefier was adjudged the prize winner. Because of his project, and because of his superior academic record and his activity in Jets and other extracurricular

schools a real challenge and a chance to help shape the world of tomorrow."

With more than 15,000 members in 650 high schools spread throughout 47 of the 50 states and several foreign countries, Jets is rapidly assuming the position of a "4-H Club" in the engineering field. As Conrad and the Society see it, the Jets mission is in essence to "save" the profession of engineering; the clubs are combating long domination of high school extracurricular activities by the science clubs, and are helping to counteract the trend toward making everybody a scientist.

The importance of counteracting this trend is underscored by some figures and findings of the Engineering Manpower Commission. According to the commission, freshman engineering enrollment in the United States declined 11.1 percent in 1958 and 3.5 percent in 1959, despite a rise in over-all freshman college enrollment.

A study made by the deans of the country's leading engineering schools attributes the decline in engineering enrollments to three things:

- A false appraisal of the long-range engineering career opportunities by counselors, students and parents.
- Increased interest by potential engineering students in other scientific fields.
- Increased concern about the rigors of engineering curricula.

A just-released report of a six-member Engineers Joint Council delegation to Russia adds critical em-

Solve Manpower Shortage

work, Greg was chosen by the Jets national directors as the 1960 National Junior Engineer. His award carried with it a trophy, a trip to Washington accompanied by his Cedarville science teacher Wilma Parr, and a summer on the campus at Michigan State. Greg will enroll this fall at MSU. . . .

One of the Jets directors who honored Greg was the ASTME's Harry Conrad, who was named to the Jets board a few months ago. After his attendance at the directors meeting in East Lansing, Conrad came away with the definite impression that the young organization is a "ready-made means" for solving the problem of engineering enrollments.

"On the recommendation of the National Education Committee, our Society last year at Milwaukee officially endorsed the Jets movement, to the point of financial backing," Conrad declared. "These young engineers are learning engineering by doing. ASTME chapters, with their wealth of talent and their willingness to serve, should find the organization and development of Jets clubs in their local high

phases to the United States' technical manpower problem. In their survey of the utilization of engineers and engineering technicians in the Soviet Union, the Americans found technicums (technical institutions) operating an efficient and effective program. The Soviet, they reported, is producing 250,000 industrial technicum graduates annually for industry, while the United States graduates 14,000 to 16,000 annually, "of whom not over 1,000 are of the quality of those produced by the technicums we visited." In addition, Russia is graduating 108,000 engineers each year. A considerable number of technicum graduates continue their education to qualify as engineers.

In his plea to chapters, Conrad wrote: "Although the problem is current, it also has long-range implications. The decline will not be felt until graduation of the classes of the early and middle Sixties. This happens at a time when all indications point to an increased need for engineers in the future."

In the considered view of leading educators, in-

dustrialists and engineering groups, the Jets program is one of the best long-term solutions to the problem. ASTME's directors agree. In point of fact, ASTME was one of the first societies to recognize the value of the program and its inherent opportunity to merge the latent talent of young people with the professional stimulation and guidance of practicing engineers.

Some chapters beat National to the punch. In 1956, Greater Lancaster Chapter 89 became the first ASTME group to sponsor a Jets club; a dozen more have followed.

Benefits of Big Brother Role

But the big brother role of the Society might well be played much more extensively, Conrad and other Society leaders are convinced. Chapter sponsorship of the Jets program, if undertaken with tact and with no strings attached, can result in three direct benefits: a contribution to the national well-being in an area where ASTME can speak with authority; recognition for ASTME from local schools, professional groups and the community in general; and, from the selfish viewpoint, promotion of tool and manufacturing engineering among intelligent young people who can tomorrow become

members of the Society that furthers their careers.

The guidance opportunities of the Jets program cannot be overstressed, Conrad believes. Jets not only stimulates youth, but helps them to identify themselves. It can capture those with the aptitude and the personality to succeed in the engineering or technical fields, and it can direct other students toward other careers.

Jets members operate in high schools with a teacher as their sponsor. The chapter is assisted by engineers from a local industry, an engineering college, or from a professional society such as ASTME. These adults provide project guidance, technical assistance and program materials. The student members rule themselves.

"With schools reopening this month," Conrad says, "it would seem appropriate to consider what we as a Society and as individuals might do to work toward the promotion of engineering as a profession generally, and tool and manufacturing engineering specifically, among the adults and young people of our nation. . . . I would like to suggest the Jets program as one method of approach to the solution of our engineering manpower needs."

Executive director of the Jets is Richard Fallon; national headquarters is at East Lansing, Box 589.

25 Kansans Contribute to Aircraft Tooling Book

A LONG STEP toward completion of ASTME's projected book, "Tooling for Aircraft and Missile Manufacture," was taken recently in the air-minded city of Wichita, Kan.

Twenty-five Wichita tool engineers and designers—comprising the largest number of authors from a single city—met July 27 to discuss articles they have authored for the 500-page book.

Initiated in 1957 and scheduled for publication next year, the aircraft and missile book will present the latest developments in tooling techniques. It will include a composite of articles written by tooling experts from throughout the world. Manuscripts have been received from such firms as Blackburn Aircraft, Ltd., England; Sud Aviation, Paris; Fiat, Italy; Short Bros. & Harland, Ltd., Ireland; Canadair, Montreal; Saab, Sweden; Pilatus Porter, Switzerland; and Hindustan Aircraft Works, India.

Coordinating the efforts of Wichita contributors to the book is Marvin Huff, a tool engineer for Boeing Airplane Co. and chairman of Wichita chapter's technical publications committee. Contributors include the chapter chairman, D. H. Duffy, a manu-

facturing engineer at Beech Aircraft, and Prof. Lee O. Thayer, University of Wichita. A noted authority on management and economics, Thayer is also writing an article for another Society book in preparation, "Numerical Control in Manufacturing."

Other Wichita authors for the aircraft volume are David Benjamin, Don Buerki, Marcus D. Davis, John Dustin, Ray Garrett, Paul Hess, James Hill, Alfred Landis, Roy Myer, Merle Neagle, Charles Newman, Wayne L. Orr, Leonard Perkins, Robert Samuelson, Glenn Stearman, William Unruh, Waldo C. Voth, Otis White, R. O. White, Douglas Woelke, Dick Wyland, and Vance Rogers.

Out-of-town participants in the Wichita workshop session included Raymond E. Garriss, senior tool design engineer for Douglas Aircraft, Long Beach, Calif., who is chairman of ASTME's National Technical Publications Committee; Francis L. Edmondson, tool and operations assistant supervisor, Convair, Fort Worth; Frank W. Wilson, Society director of technical publications, and Walter Prange, ASTME assistant books editor.



Maj. Gen. Osmond J. Ritland, California Day Luncheon speaker, now head of the Air Force Ballistic Missile Div. of Air Research and Development Command in Los Angeles, is a much-decorated former commercial and test pilot. From 1944 to 1946 he commanded the Assam Air Depot in India, and he was also connected with the Atomic Energy Commission's proving grounds in Nevada.

FOR THE THIRD TIME the city of Los Angeles will play host to the American Society of Tool and Manufacturing Engineers and their Western Engineering Conference and Exhibit. The first was in 1955, the second in 1958.

Something new has been added, though. Quite a something! It's the huge Los Angeles Memorial Sports Arena in which the Society will stage the largest production equipment exposition on the West Coast. More than 200 exhibitors are expected to display over 2000 products.

The exhibit will run concurrently with the Society's semiannual engineering conference, consisting of a number of technical sessions, "tech tours," plant tours, meetings, and social functions.

The first event of the four-day program is the California Day Luncheon. Maj. Gen. Osmond J. Ritland, commander, Air Force Ballistic Missile Div., Air Research and Development Command, Los Angeles, has been chosen to speak at this function. His topic—"The Air Force Ballistic Missile and Space Program."

L. A. Program Shaping Up

Ritland is a command pilot with more than 9000 flying hours to his credit who, for the past few years, has had administrative responsibilities for research and development of Air Force ballistic missile weapon systems and related military space programs.

The AFBMD manages and directs, under the highest national priority, the development of Atlas, Titan, Minutemen ICBMs and the Thor IRBM. The division commanded by Ritland also engages in the research and development of military space systems and conducts certain scientific space programs in cooperation with the National Aeronautics and Space Administration.

The success of both the Public Affairs Forum and the Business Outlook Luncheon held at the annual meeting in Detroit this April, has prompted the Los Angeles host committee to schedule another similar pair of events during this Western meet.

The wives of ASTME members making the trip to the Coast will not be forgotten. While their husbands attend to the Society business at hand, they will be playing the tourist role at local attractions. The Ambassador Hotel will serve as headquarters for both men's and women's activities.

Rudolf Regen, a member of the San Fernando Valley ASTME chapter, is the man heading up the engineering conference and exhibit host committee. An honorary host committee has also been named, however. It includes A. O. Beckman, president of Beckman Instruments, Inc.; Hugh J. Clary, president of Clary Corp.; Donald W. Douglas, Jr., president of Douglas Aircraft Co., Inc.; Robert E. Gross, chairman of the board and executive officer at Lockheed Aircraft Corp.; H. Leslie Hoffman, president of Hoffman Electronics Corp.; Dan A. Kimball, president of Aerojet-General Corp.; Charles W. Lee, president of Consolidated Western Steel Div., U. S. Steel Corp.; and K. T. Norris, chairman of the board at Norris-Thermador Corp.

the punishment	wise men suffer
for indifference	to public affairs
is to live under	the rule of unwise men
	... Plato



The Engineer

NO MAN—not even an engineer—is an island. But engineers as a class have traditionally tried to erect islands around themselves.

When Utah Governor George D. Clyde, himself an engineer, declared at the ASTME's recent Public Affairs Forum in Detroit that "engineers tend to fall below rather than rise above the norm in their acceptance of their responsibility to the community," he was admittedly putting it mildly.

Due in large measure to the efforts of concerned individuals such as Governor Clyde, the situation is rapidly changing. More and more engineers are getting their feet wet in the sea of civic responsibility.

In this season of bandwagons, the engineer's involvement in politics is particularly noticeable. Rightly or wrongly, he is frequently shucking his social withdrawal tendencies and climbing aboard bandwagons—getting exercised over issues, tilting at windmills, ringing doorbells, passing out campaign handbills, collecting political contributions, serving on party committees and getting people to register and vote.

The engineer is perhaps better fitted than some other professions for his new role as a citizen. Thomas R. Reid, civic and governmental affairs manager for Ford Motor Co., said at the ASTME forum: "Engineers have specific talents that lend themselves particularly well to the subject of civic responsibilities." Governor Clyde made the point

succinctly: "The engineer is trained to gather the facts, analyze the facts—and face the facts."

It is generally agreed that facts are needed in practical politics. The enlightened approach which engineers could potentially bring to political science would help refute the classic cynicism of Henry Adams who said that "practical politics consists in ignoring facts."

It is a well publicized fact that American industry has lately followed the lead of its opposite number, the American labor movement, and has jumped into politics feet first. It is also a fact, not so well recognized, that the momentum of this trend has carried along not only businessmen and executive personnel, but the professional individuals who are industry's corpuscles, the engineers.

Specific recognition of the engineer's expanding sense of his responsibility as a citizen was the Detroit forum, mentioned above, which formally programmed a discussion of "The Engineer's Responsibility to His Community" at the ASTME's annual conference. Subsequently, the National Public Relations Committee published a booklet in which is digested the material presented at the forum. The Society brochure will be circulated among the nation's top industrial management to further exemplify ASTME members' concern for good government.

An even more personal and convincing index of the tool and manufacturing engineer's plunge into

articulate citizenship can be found, among other places, at Syracuse, N. Y.

Among the alumni of the famed Practical Politics courses at Syracuse are the following dozen members of ASTME Chapter 19:

Arthur L. Brzezinski, Donald W. Darrone, Jay E. Endres, Linton E. Floyd, John O. Garrett, Francis B. Hall, Paul H. Hansel, John H. Metz, E. L. O'Donnell, Charles Stoddard, LeRoy M. Urban and John J. Wawro. Random sampling shows the president and a supervisor from Allen Tool Corp. (Darrone and Stoddard); the manager of manufacturing engineering at Carrier Corp. (Endres); the manager of production engineering at Brown-Lipe Chapin Div. of GM (Wawro); the superintendent of L. and J. G. Stickley Co. (Metz).

The so-called Syracuse Plan faces the reality that good government can be achieved only when all the people and all elements of the population exercise an effective amount of participation in public af-

tribute money to a political cause, the seminars are not designed to push the fortunes of any party. Their purpose is to train industrial and business people to advance themselves to positions of importance within the party of their choice.

Follow-Up Shows Marked Success

According to Frank O'Neill of the Manufacturers Association, the seminars have graduated some 1400 in the Syracuse area, and follow-up surveys have indicated the marked effectiveness of the educational program. Of 540 respondents to a postelection survey of Practical Politics alumni, 97 percent signified that they went to the polls, compared with a 68 percent over-all voting record in the area. Forty percent had participated in some kind of political activity since taking the seminar. One in every five belonged to a political club; one in every 12 held a party or public office; one in every 20 ran for party or public office in the election; one in every

as a Citizen

By M. L. Stone, News Editor

fairs, in governmental relations, and ultimately in politics. It further recognizes that clean politics must begin at home.

The action program embodied in the Practical Politics seminars has been widely copied. Begun in 1958 as an experiment, it has grown steadily into a blueprint for similar business and industry action throughout the country. Notably successful variations have been sponsored by the National Association of Manufacturers and the U. S. Chamber of Commerce, as well as by individual companies and corporations such as General Electric, Ford, Aerojet-General.

Do-It-Yourself Political Kit

The program includes a do-it-yourself kit containing slide films, a political primer, tape recordings, students' and leaders' manuals, plus details of a five-step plan for implementing the program in a particular locality. The kit is obtainable from the sponsoring Manufacturers Association of Syracuse.

At the heart of the program is the 11-week seminar of two-hour workshops. The current cycle of seminars in Syracuse area plants numbers about 16 groups, averaging 15-20 participants each. Syracuse ASTME members are considering chapter sponsorship of such a seminar. Cost per participant does not exceed \$20 for all material.

Since industries, as corporate entities, cannot con-

tribute money to a political cause, the seminars are not designed to push the fortunes of any party. Their purpose is to train industrial and business people to advance themselves to positions of importance within the party of their choice.

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- Write personal letters to his Congressmen
- Attend a community council meeting and meet his councilman
- Personally contact one of the two state senators from his district
- Make a complete breakdown of property taxes paid, where paid, plus an appraisal of services for taxes paid
- Interview election district committeeman
- Ring 20 doorbells in his neighborhood, canvassing families on registration
- Report ideas for more voter registration in his neighborhood and his company; then send his recommendations to top management
- Report ideas for internal company public affairs program, also sending these to his management.

Ford Motor's Reid, in reporting on his company's recently launched program to convince its 152,000 employees that government is their business, asserted at the ASTME forum that perhaps engineers are not as disinterested in public affairs as is generally believed.

"A third of the several hundred employees who



Demonstrating ASTME's growing concern for its members' roles as citizens, these four men discussed "The Engineer's Responsibility to His Community" at the Society's annual conference in Detroit. Left to right are Thomas R. Reid, civic and governmental affairs manager for Ford Motor Co., who moderated

the discussion; Governor George D. Clyde of Utah; Dr. Stanley J. Idzerda, Honors College director, Michigan State University; and Arthur S. Griswold, vice president, Detroit Edison Co. Also on the panel was Hershel C. Atkinson, vice president of the Ohio Chamber of Commerce.

had received the (citizenship program) presentation so far were signing up for the practical politics course," Reid said. "In the engineering and research staffs, I was informed that about half of those who were exposed to the presentations were signing up for the course."

The total objective of these efforts to make industry's leaders aware of their responsibilities as citizens is to return government to the people. And an added benefit for the public, Governor Clyde believes, would be to inject the engineering and analytical point of view into our government thinking at the policy-making level.

"I am firmly convinced," Clyde declared, "that

engineers should be professional not only in their own specialized fields, but also in their approach to civic and governmental responsibilities."

Some observers believe that the engineer's collective personality, traditionally retiring, is undergoing a revolutionary change. Not even cloud nine formulas and slide rule emotions, they contend, can insulate the engineer from involvement nowadays with other people, with society, and with the body politic.

The Syracuse experience indicates that tool and manufacturing engineers are meeting the challenge of informed citizenship. They are gathering the facts, analyzing them—and facing up to them.

Expert Traces Metrology Back to Builder of Pyramid

KNOXVILLE-OAK RIDGE—"Do heads roll in your plant's inspection department when the inspectors do not standardize their micrometers?" In Khufu's time (king of Egypt, circa 2900-2877 B. C.), when he was building the Great Pyramid, the inspectors on the job were required to check their cubit rods against the royal standard each month. Any inspector who failed to do so was likely to have his head removed.

This is the first recorded instance of in-process quality control and it paid off for Khufu. The base of the pyramid is 755 ft long and the error is less than 1/2 inch. This unusual side light, along with many others, was disclosed to 45 members of Chap-

ter 107 by Leonard G. Whitten, Jr., engineer at Union Carbide Corp.'s gaging laboratory.

In the present day, Whitten said, because of the increased accuracy of machine tools in general, inspection methods and equipment have undergone a remarkable revolution. He showed slides of various pieces of equipment which are used to check inspection standards and which are capable of accuracies in the order of ten millionths inch. In the future, Whitten reflected, it appears that the standard will be a light source which has a constant wave length. Called interferometry, the most promising light source will probably be that produced by Krypton (atomic element 36). —R. D. Ellingson

Members in the News

ALBERT L. GUTTERSON, president of Lovejoy Tool Co. of Springfield, Vt., and member of Twin States ASTME chapter, was awarded the degree of doctor of science at the University of Vermont's 169th commencement exercises. Dr. Gutterson is an alumnus of the university, class of 1912.

After 20 years' experience in the governmental and commercial sales engineering field O. A. LINSE, Cincinnati, has been appointed assistant to the vice president of Pomona Div. of the Marquardt Corp. His responsibilities will consist of marketing planning and promotional and sales training development activities. Formerly assistant to the president and sales manager of Burton-Rodgers, Linse has served as president and sales manager of International Industrial Corp., Baltimore. His background also includes service with the Office of Naval Research and with the Bureau of Aeronautics.

H. J. URBACH, Canton chapter, formerly company executive engineer for Timken Roller Bearing Co., has been named director of engineering. Joining Timken in 1933 in the Railway Engineering Department, he was made design and service engineer in the diesel fuel injection department in 1949, two years later advancing to executive engineer.

PAUL N. STANTON, a registered professional engineer of Chicago chapter, has been named vice president of marketing with Pratt & Whitney, Inc. He comes to P&W from Clearing Machine Corp., Div. of U. S. Industries, Inc., where he served as general sales manager, and previous to that time with LaPointe Machine Tool Co. in the same capacity.

With a background of 12 years at Lodge & Shipley Machine Tool Co. and 9 years with Giddings & Lewis Machine Tool Co., ROLAND HECKER of Fond du Lac chapter will bring his machine tool engineering and design experience to his new position as chief engineer of Burg Tool Mfg. Co., Inc., Gardena, Calif.

HARRY W. MCKEE, Chicago, has been appointed manager of Crucible Steel Co., Twin Cities sales branch. . . . MORTON ARNOVITZ, Detroit chapter, has been named responsibility sales manager for Mark Engineering Co. Arnovitz was formerly foreman for Berkeley Tool and Schaeffer Products. During his service with Mark he has specialized in jigs and fixtures, experimental prototypes, general machining and close tolerance production. In their new Detroit quarters they are machining some of the new exotic

metals for missile programs. . . . Formerly assistant branch manager for The Carpenter Steel Co., GERALD R. GARINGER, a member of Toledo chapter, has been promoted to branch manager, Indianapolis. Garinger will be responsible for warehouse management and for mill and warehouse sales in Indiana, Illinois and Kentucky. . . . JOSEPH W. DUBA, formerly assistant manager at Crucible Steel Co.'s Cincinnati sales branch, has been appointed manager. Duba joined Crucible in 1941. He is a graduate metallurgist and a member of Cincinnati chapter.

Appointment of JOHN J. DEVLIN to sales representative for Morse Twist Drill & Machine Co. has been announced. Devlin, a member of Long Island chapter, has had several years' experience in the cutting tool field as a sales representative in New England and Memphis, Tenn., areas. . . . Formerly western manager for American Drill Bushing Co., RAYMOND L. DONALDSON of San Gabriel Valley has joined Besly Welles Corp. as service representative for the West Coast territory. Prior to joining American Drill, Donaldson was sales engineer with National Twist Drill & Tool Co., Los Angeles.

Following a number of years as representative for Standard Tool Co. in southern Ohio, FRED S. HAAS, JR., Cincinnati member, has been appointed Chicago district manager. . . . ALLAN B. HUGHES, Northern New Jersey, has been appointed West Coast district manager for Bay State Abrasive Products Co. Hughes joined the Massachusetts grinding wheel firm in 1947; for the past several years he has been an abrasive specialist serving Pennsylvania and New Jersey areas. . . . Coincident with the expansion program of the marketing organization for precision boring and turning machines produced by the Industrial Machinery Div. of American Electronics, Inc., PETER J. WALENT, Worcester, has been named customer relations manager for the division.



Urbach

Stanton

Hecker

Research Reports Reviewed

THREE RESEARCH REPORTS—two brand new entries in the ASTM Research Fund Committee's list of project reports; the other, part three of a bibliography—have recently been made available by the Society. Research Reports Nos. 27 and 28 have come about as a result of the Society's Metal Stamping Project, currently being conducted at Syracuse University. Report No. 29, prepared by ASTM member Orville D. Lascoe, professor of industrial engineering at Purdue University, is Part III of a *Plastics for Tooling Bibliography*.

R. Tilsley and F. Howard, research manager and senior research engineer, respectively, at Production Engineering Research Association, Melton Mowbray, England, are the authors of Report No. 27. The report is entitled "Recent Investigations Into the Blanking and Piercing of Sheet Materials." The paper describes studies made of some of the factors affecting the blanking and piercing operation and attempts to link this work with the requirements of the presswork engineer.

A recent metallographic study of sections taken through sheared surfaces provided the authors with an indication of the possible mechanism of shear

when blanking circular components from strip material. Another series of tests involving the punching of 1-inch-diam holes in mild steel, stainless steel, brass, and aluminum alloy resulted in information on punch and die clearance which is revealed in this research report. Tilsley and Howard also take it upon themselves to clear up the misunderstanding that surrounds the word "shear" in pressworking operations.

Angular shear of cutting edges, speed of blanking, finish blanking, and power presses and tooling are a few more areas concentrated upon by the two Britons. Research Report No. 27 deals with a process which is presently the most popular and most important production technique in this country.

The information contained in Research Report No. 28, compiled by James N. Embree, was released through the courtesy of The Emerson Electric Mfg. Co. of St. Louis. It deals with the "Determination of the Loading of a Henry and Wright Dieing Machine at Various Speeds and with Different Types of Punch Grind on Lamination Die."

Technicians at Emerson set a two-fold objective at the outset of the series of tests described in the report. Because the company's electrical department was having difficulty meeting the increased demand for motor laminations, it wanted, first, to determine the effect of changes in operating speed and, second, the effect of a change from flat-ground to shear-ground punches on the press load and performance.

Embree, electronics engineer in Emerson's armament department, conducted the instrumentation and test work, the summaries of which are drawn up in this paper. Printed lists of tables, illustrations, calibration of gages, and other data reveal that "the main operating members of the dieing machine were not loaded any more severely when operating at 150 strokes per minute with the partially shear-ground die than when operating at 113 strokes per minute with the flat-ground die."

"Plastics for Tooling Bibliography, Part III," produced after an extensive search and review of published technical articles on plastic tooling both domestic and foreign, spans the period from June 1, 1959, to May 31, 1960. ASTM Research Director Leslie S. Fletcher gave the go-ahead to Orville D. Lascoe, overseer of the compilation project, after some 21 organizations had contributed financial support. Industrial firms, authors, and publishers also lent a hand in turning out the research report. The outcome is 368 (ASTM Research Report No. 5 contains the first 254 abstracts, No. 15 includes abstracts 255 to 446) clear, concise abstracts of technical articles ranging from "The A. B. C.'s of Plastic Tooling" to "Yield in Epoxidation Reactions."

chapter news



Tosh Nitta, a student at Tustin High School, accepts the certificate he received along with a *Tool Engineers Handbook* and drafting equipment, as a result of winning Santa Ana Valley's "Junior Tool

Engineers Drawing Contest." The chapter's education and scholarship chairman, Glen Larsen, hands the parchment over as Chairman Don Eells (left) and Lowell Schroeder, the students' instructor, look on.

Santa Ana Valley Chapter Picks a Design Winner

SANTA ANA VALLEY—Recognizing the noted lack of rapport that often exists between recently graduated students and their new employers in industry concerning actual on-the-job experience, Chapter 119 has for the past five years taken it upon itself to inform local high school students of essential knowledge and skill requirements.

The fifth annual "Junior Tool Engineers Drawing Contest" recently drew to a close with three young draftsmen winning out over a field which included some 22 talented entries. *Tool Engineers Handbooks*, drawing sets and other drafting equipment went to first place winner Tosh Nitta of Tustin High School; second place, Gil Stayner of Valencia High School; and third place, Dennis Walker of Huntington Beach High School.

These three gave the best solutions to a project problem consisting of specifications for a lathe boring tool which had to fulfill certain operational requirements. Their entries were judged on practicability of design, accuracy of drawing, lettering

and arrowheads, dimensioning, line value, neatness and originality.

Santa Ana Valley's contest did not consist of merely announcing that a competition was underway and everyone was invited to enter. Months of planning went into the project. A committee formed and headed by chapter member Glen M. Larsen, himself an instructor at Santa Ana College, immediately set up a schedule of activities, the first of which was a meeting to decide what the "project problem" should be. Next a dinner meeting invitation was extended to area high school drafting teachers. They were told the contest rules and purposes and encouraged to promote the idea in their classes. It was suggested members of the chapter create interest in the contest by speaking before groups in schools near them.

Finally, when the best entry from each high school had been selected, points awarded each drawing by judges on a rating sheet were averaged and the field narrowed to three. Corrections and com-

ments were made in red on the drawings for later examination by the contestants' instructors. This provided the teachers with a means of spotting their students' weaknesses and of thereby evaluating the worth of their methods of teaching.

One feature added to Chapter 119's drafting improvement program this year was the "Drafting Practice Critique." A few weeks after the contest opened, every drafting teacher in the area was invited to attend a panel discussion dealing with the drawings made by their students. Thirty-four teachers appeared, with five members of Chapter 119 and two members of the Long Beach chapter composing the panel. ASTME members discussed, criticized and commended student drawings so that the teachers could see how their instruction compared with the requirements of industry. On some points, the teachers defended their instruction on the authority of their textbooks. The chapter members suggested that perhaps many textbooks are out of date and may have been authored by persons whose primary business is the authorship of books rather than professional industrial drafting.

Santa Ana Valley's educational activities do not stop with drafting contests and critiques. Since 1957 they have awarded over \$1200 in scholarships to students in area junior colleges who intend to pursue further studies in engineering or industrial education on a higher level. —James D. Spivey

Charter Member of Society Dies

DETROIT—O. L. Chapman, 78, one of the first 10 members of Detroit chapter, died July 26 at Saratoga Hospital. He was associated 25 years with Accurate Tool Co. and Excelsior Tool & Gauge Co. His wife Leona survives.



TWIN STATES—Chairman Glenn Easton awards James Michniewich, a student at Springfield High School, with Chapter 40's annual \$200 scholarship. Michniewich, who works on a cooperative plan at Jones & Lamson, plans to enter the University of Vermont's school of engineering this month.

—N. Gourley

special events

Wisconsin Council of Chapters' First On-Campus Conference	Oct. 29, 1960	Marquette University Milwaukee, Wisconsin
ASTME Semiannual Meeting	Nov. 14-18, 1960	Ambassador Hotel Los Angeles, Calif.
ASTME Western Tool Show	Nov. 14-18, 1960	Memorial Sports Arena Los Angeles, Calif.

Wisconsin Chapters Slate First Campus Conference

MILWAUKEE—The recently organized Wisconsin Council of ASTME Chapters will sponsor its first On-Campus Conference at Marquette University here on Saturday, Oct. 29.

Joseph Mundbrot is general chairman of the conference.

Wisconsin chapters include Racine, Milwaukee, Fond du Lac, Madison and LaCrosse.

Mundbrot, who is past chairman of Milwaukee chapter and currently a member of the National Professional Development Committee, has announced that the Marquette conference will include four technical sessions. All will contribute to the central theme, "Tooling for Small-Lot Production."

Nick Bereznoff, superintendent of production engineering of AC Spark Plug Div., GMC, will discuss steel rule dies. "Economics of Tooling" will be the topic of Chief Engineer Harry Conn of Scully-Jones & Co. On the afternoon program will be a talk on "Advantages of Plastic Tools for Small-Lot Production," by Robert Lemaster of Nelson Pattern Works; and "Tape Control for Small-Lot Production," by Tom Sergeant, sales manager of the Machine Controls Div., Minneapolis Honeywell Regulator Co.

National Education Director Gilbert E. Seeley will be toastmaster at a luncheon meeting at which Dr. Bernard Drought, engineering dean at Marquette, will address the conferees on "Manufacturing Engineering: A Creative Profession."

A talk on "Industry and the Missile Age" will be given by Dr. James Bell, director of guidance and navigation of AC Spark Plug Div., at the evening banquet. In addition, ASTME President H. Dale Long of Chicago will give a "Report from National Headquarters." Evening toastmaster will be Duane H. Brighton, national director-elect from Peoria, Ill.

Officers of the Wisconsin Council include Chairman John W. Kellogg, chief tool designer of Twin Disc Clutch Co., who is currently Racine chapter

chairman; Prof. Roy A. Lindberg of the University of Wisconsin, first vice chairman of the council and chairman of Madison chapter; Ralph L. Perlewitz, assistant chief engineer of Geo. J. Meyer Mfg. Co., secretary-treasurer of the council and chairman of Milwaukee chapter.

Prof. Raymond J. Kipp, Engineering Institutes Director of Marquette, is cooperating with the ASTM council in working out arrangements for the campus conference.

St. Louis Member Dies

ST. LOUIS—Fred Sachleben, 65, member of St. Louis ASTM chapter since 1938, died here July 31. An outstanding member and supporter of his chapter for many years, he acted as chairman of the committee for the revision of the *Tool Engineers Handbook*, rewriting Sections 32, 83 and 84. He also served on a Research Fund steering committee. At the time of his death he was assistant to the vice president of Emerson Electric Mfg. Co. He is survived by his wife Thelma and one daughter.

Broad Curriculum Urged At Coast Council Meeting

SAN FRANCISCO—Sixty delegates from a dozen California Council chapters, in addition to representatives from chapters in Denver and Portland, Ore., were warned recently that "while we might win wars on the battlefields, we can lose them on the rice fields."

Nathan H. Boortz, director of technical education at Foothill College, Mt. View, Calif., told the California Council meeting here July 16 that higher education faces many problems in satisfying demands for both general and specialized education.

"The challenge that must be faced by modern education is the development of a curriculum that can teach the skills that go into creating the necessities of life, but still give heavy emphasis to the social sciences and to the culture that is our heritage," he said.

The delegates devoted most of the day, July 16, to discussion of methods of improving chapter operation and to an exchange of information concerning mutual problems. National Director G. Ben Berlien of Oakland discussed the long-range planning that has occupied the attention of the Society's leaders in recent months.

Plans for the Western Engineering Conference and Exhibit, scheduled at Los Angeles Nov. 14-18, were outlined by E. Leo Koester, technical information services director for the Society at National Headquarters. "The 14 technical sessions being offered at the conference are an educational opportunity you cannot afford to miss," he said. "For a

little time and a monetary investment less than the price of a carton of cigarettes, you can bring yourself up to date on outstanding developments in creative manufacturing research."

Preceding the council activities was a meeting of members of the Los Angeles Host Committee. Chairman Rudolph Regen and his group discussed the technical sessions, special events and 10 or so plant tours that will accompany the semiannual meeting and tool show, the latter of which will be staged in the Los Angeles Sports Arena.

position wanted

TOOL ENGINEER—Graduate mechanical engineer, 29 years old, with good experience in tool fabrication work like press tools, dies, jigs and fixtures, gages, molding and die casting tools, experience in all types of machine tools, desires position as a tool engineer in the shop side in any manufacturing light industry. Write to Classified Ads, Dept. 185, 10700 Puritan Ave., Detroit 38, Mich.

positions available

CHIEF TOOL ENGINEER—Long-established manufacturer of heavy industrial, mining and construction machinery has need for a technically trained tool engineer with a proved record of successful tooling and supervisory experience. To be considered, the applicant must be completely familiar with all types of heavy production machine tools including general tooling, jigs, fixtures, basic machines and heat treating. Experience with punch card and tape-controlled milling and drilling equipment will be required in the successful applicant. This is a career job with tremendous strides to be made in the tooling and process field over the years. The job to be done will prove to be a real challenge and a real opportunity to the right man. Give full details of age, experience, education, supervisory experience and salary desired. Personal interviews will be arranged for those meeting the qualifications. Write to Classified Ads, Dept. 184, 10700 Puritan Ave., Detroit 38, Mich.

FIELD SERVICE ENGINEER—with extensive cutting tool experience and acceptance in metal fabricating industry, by a well-established Pennsylvania manufacturer of taps, dies, reamers, end mills and milling cutters. Excellent compensation and future. Reply in confidence to Classified Ads, Dept. 186, 10700 Puritan Ave., Detroit 38, Mich.

TOOL ENGINEERING REPRESENTATIVE—Aggressive firm offers Michigan and adjoining coverage on cutting tools and related perishables. Strong field engineering, efficient office, and good design capability. Facility sufficient to permit small warehousing. Grinding equipment available for rework of standard items. Can handle either representative or distributor arrangement. Good financial standing and reputation for business integrity. For further information, write to Classified Ads, Dept. 183, 10700 Puritan Avenue, Detroit 38, Michigan



SOUTH BEND—Members of Chapter 30 listen as guest speaker J. Herbert Lund (second from right), regional sales manager of Dynapak Convair, a division of General Dynamics Corp., demonstrates part of

the display he used in his talk on "High Velocity Metal Working" at a recent meeting. The South Bend members are (left to right) Robert Slack, Dean Zimmerman and Bill Gaines.



CALIFORNIA POLYTECH—Ray Working (left), elected new chairman of Student Chapter 12, received an additional honor in the form of *Tool Engineers Handbook* from Don Eells, chairman of Santa Ana Valley senior chapter. Working brought in 33 new student members.
—Roland Olson



ATLANTA—O. J. Seeds, manager of the alloy department, Cerro de Pasco Sales Corp., explains one aspect of "Cerro-Technics" to a member of his audience at a chapter meeting. The program included discussion of the characteristics and uses of low-melting Cerro alloys.
—Gene Cole



Reports in Brief . . .

Northeast

A Kearney & Trecker Corp. sales engineer and field representative, George Gunderson, was the guest speaker at KEYSTONE's June technical meeting. His discussion of "Numerical Control Machining" was accompanied by a color film illustrating the countless applications of this type of machining along with the advantages and disadvantages. Chapter Chairman Frank Forquer took the opportunity to comment on "The Ethics of Tool Engineers."

Frederick W. Becker of Albany, N. Y., and a member of ASTME's HENDRICK HUDSON chapter, died recently. He was employed as superintendent at the Metal Parts Machining Corp.

South

ATLANTA Chapter 61 recently played host to 24 representatives from 9 ASTME chapters. The gathering was held in order to prepare initial procedures and elect officers for the Southeastern Council of Chapters. National Vice President and Director Frank Ford and National Membership Committeeman E. M. Ketchie attended the meeting in advisory capacities. The officers of the new council are Chairman Harmon Shaw, Piedmont chapter; First Vice Chairman Ray Culver, Atlanta chapter; Second Vice Chairman Justus Alexander, Mississippi chapter; Treasurer Les Kelly, Nashville chapter; and Secretary Chet Collins, Bristol, Tenn.-Va. chapter.

Rocky Mountain

More than 50 members of PHOENIX chapter heard Harry A. Whitefield speak at their June meeting.

Whitefield, West Coast engineering representative for Anocut Engineering Co. of Chicago, chose as his subject—"Electrolytic Grinding."

West Coast

This June approximately 45 members of the SEATTLE chapter journeyed to Newhalem, Wash., to view the Skagit River hydroelectric project operated by the Seattle City Light Power System. After traveling the 100 miles, the members and their families received a briefing by a company representative, then began the tour of the three dams—Gorge, Diablo and Ross, which provide electric power for the surrounding area.

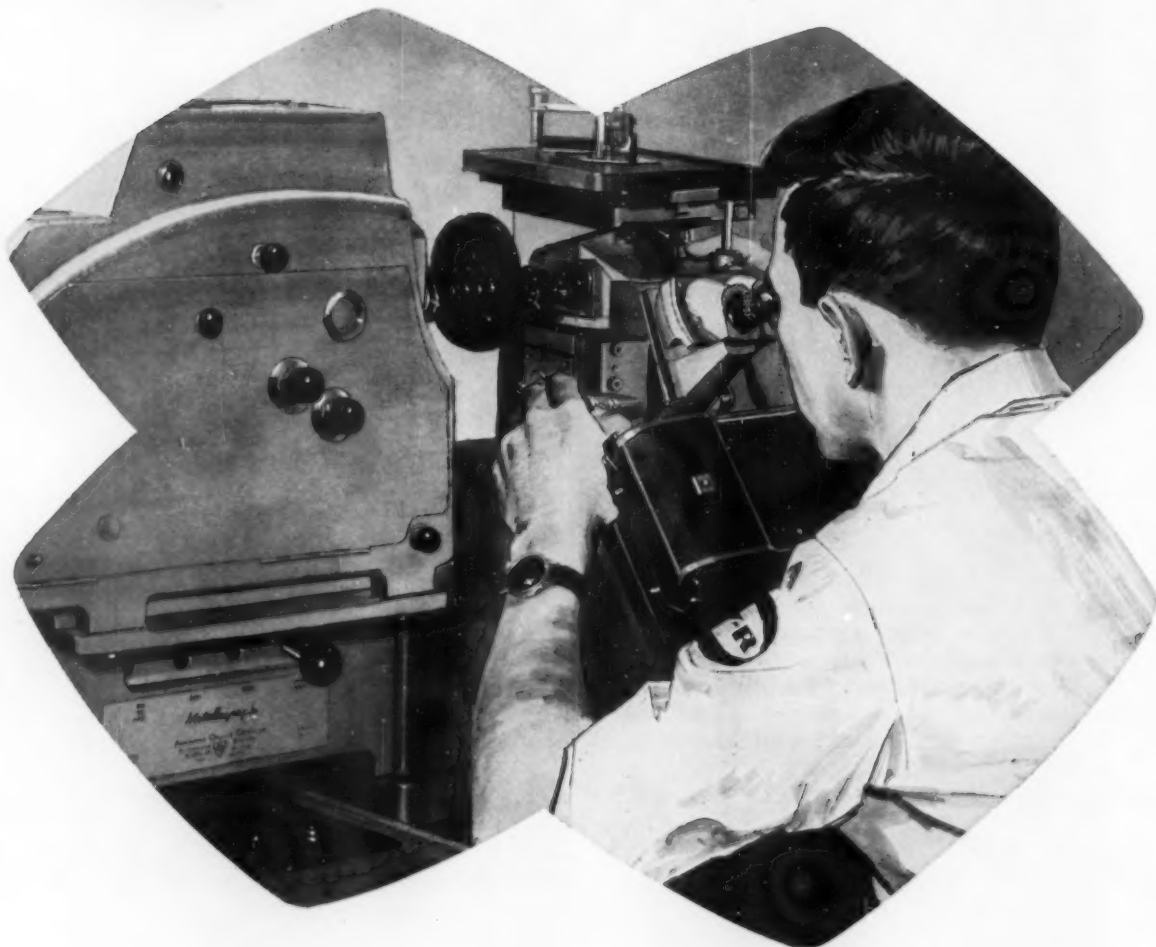
Clifford Rizor, a member of the Seattle chapter, passed away recently. Rizor had been a tool engineer for many years, working most recently at Boeing in Seattle. Prior to this he was with Boeing in Wichita, Douglas Aircraft and GM.

Australia

Utilizing home-grown talent has become a common practice of the SYDNEY ASTME chapter. The highlights of both their May and June meetings have been talks by chapter members on timely and important technical subjects. In May the group's second vice chairman, Ken Edensor, delivered an address on "Dimensioning and Tolerancing Techniques for Analysis of Engineering Design." George J. Moulang, chapter editorial chairman, was the "guest" speaker at the June gathering. His talk dealt with "Spark Erosion—a New Process for Industry." More than 120 members and guests attended this last affair.



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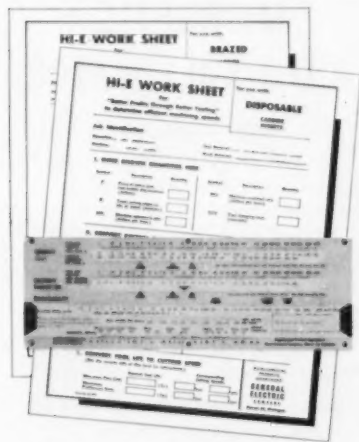
C-801

Progress in Production

HIGH-EFFICIENCY MACHINING —A NEW APPROACH

Formulas for determining the most efficient speeds for metalcutting operations have been in use for many years. Most of these formulas require extensive mathematical calculations—a factor that hinders their application in some plants.

Lengthy calculations are eliminated in a new approach developed by the Metallurgical Products Dept. of Gen-



Work sheets and special sliderule permit determining best cutting speeds.

eral Electric. Known as "Hi-E," the approach is basically a method designed to help achieve high-efficiency machining by determining the cutting speed that will result in either the lowest cost per piece machined or the highest production rates. The best cutting speed for a given operation usually lies between these extremes.

A special sliderule is used to calculate cutting speeds, feeds and depths. Simplified work sheets are used to record pertinent data such as tool life, cutting speed and output, as well as labor, overhead and tool costs.

Using the sliderule and work sheets, the best cutting speed for an operation can be determined within 10 minutes or less, without shop testing.

General Electric is making its simplified method for calculating high-efficiency cutting speeds available to the entire metalworking industry. General Electric field engineers will give assistance to users in applying the method.

EPOXIES PUT TO WORK IN COMPUTERS

Librascope Div. of General Precision has developed a new potting and protective coating technique to protect computer subassemblies against humidity, contamination, shock and vibration. Logic cards, the printed circuit boards that comprise the "intelligence" of electronic digital computers, are dipped in or sprayed with epoxy plastic, which



Digital computer logic card is dipped in epoxy plastic for protection.

has extreme resistance to heat, cold and abrasion. The coating can be applied at room temperature and then set at temperatures sufficiently low to prevent damage to the sensitive transistors, diodes, resistors and capacitors that make up the logic card circuits.

Once coated, the circuit boards are baked at a maximum temperature of 150 F to harden the thermosetting

epoxy. Temperature control is important because the heat must be adequate to cure the plastic without damaging the performance of the delicate electronic components. Masking tape, used to keep contacts and terminals free from the plastic coating, is removed after the boards leave the oven.

In the potting operation two or more circuit boards are joined in parallel, forming an openside box type construction. The electronic components on the inside of the box are protected by filling the space with plastic. The boards are placed in jigs and epoxy, with special fillers added to provide maximum heat dissipation, is poured in. The assemblies are then oven-cured in the same manner as the coated boards and the jigs removed.

On removal from the oven both coated and potted boards are given a complete visual and dielectric inspection. Before delivery to the final computer assembly area, each unit receives a complete performance checkout.

CAM REDESIGN ELIMINATES SCREW MACHINE JOGGING

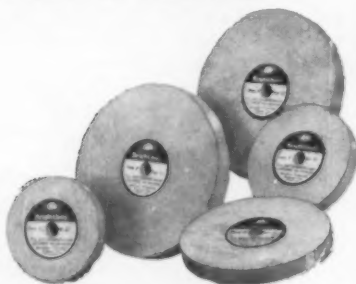
A rapid travel cam, redesigned by the Timken Roller Bearing Co., eliminates the problem of jogging automatic screw machines. The problem arises when a machine that is out of stock stops automatically before the chuck fully opens. The machine must then be jogged to a



Rapid travel cam before revision (top) and split cam with spacer (bottom).

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Progress in Production

point where the chuck will open and the stock stop can be raised.

The redesigned cam is split, with a spacer between the two halves. When the screw machine stops automatically, the spacer permits the cam to keep the collet open for the removal of the stock butt. The cam drum, receiving the kinetic energy of the drive pulley, coasts until the chuck opens and the electric brake stops the rotation of the cam-shaft.

BRAZING CUTS COST AND WEAR OF BLADE ASSEMBLY

Produced as a one-piece iron casting, a commercial meat cutter blade assembly wore rapidly because the cutting surface was exposed to corrosive oils, fats and juices. Produced as a one-piece casting of stainless steel, the assembly had a longer life but cost 50 percent more per casting.

A new blade assembly design, developed by the Stainless Processing Div.



Meat cutter blade assembly. Stainless-steel blades are joined to cast-iron body in brazing operation.

of the Wall Colmonoy Corp., combines the lower cost of iron and the longer wear of stainless steel. Blades blanked from 1/8-inch Type 302 stainless-steel sheet are brazed to a cast-iron spider with Microbraz brazing alloy in a dry atmosphere at 2150 F. The resultant assembly costs 40 percent less than the stainless-steel casting, outlasts five cast-iron assemblies and requires less finish machining than the one-piece castings.

SILENT SOUND SOLDERS "UNSOLDERABLE" MATERIALS

Materials such as aluminum, silicon, germanium and ferrites, once considered difficult or almost impossible to join, are now being soldered without difficulty, using a Raytheon ultrasonic

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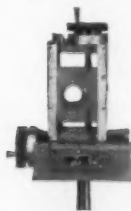
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such as photo cells,
probes, etc., in place
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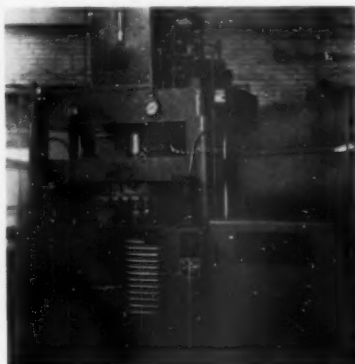
joining unit. The reason for soldering difficulties with these materials is their tendency to form a surface film of oxide. Solder without flux cannot penetrate this film to wet the surface. The new unit excites the molten solder and breaks down the oxide film.

An ultrasonic generator, operating off 60-cycle current, powers the ultrasonic soldering machine. The current, converted to 25,000 cps, actuates a tool tip that excites the molten solder on the surface of the workpiece. Strokes of the tool tip are 0.001 inch long. The unit is portable, weighing 45 lb.

COMPACT WELDING TRANSFORMER HAS HIGH OUTPUT

When resistance welding demands exceptionally high primary power to concentrate large amounts of current in a small area, conventional transformers become impractical because of the high-ampere output needed. Special transformers developed by National Electric Welding Machines Co. are extending the range of resistance welding applications in the automotive industry.

The new transformers deliver four to six times the welding current of a



Butt welder for automobile fluid coupling housings has compact transformer, requiring minimum space.

standard design for the same electrical demand. The welder illustrated, for example, requires only 750-kva power to produce 220,000 secondary amperage. A conventional welder would have needed 5300-kva power to deliver the same electrical current. The machine welds the equivalent of 4.83 square inches in butt welding fluid coupling housings of 0.110-inch steel, 14 inches in diameter.


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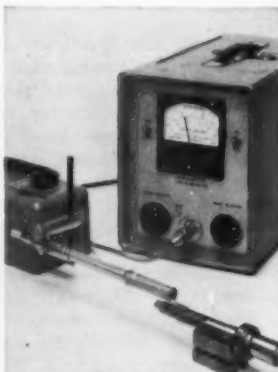
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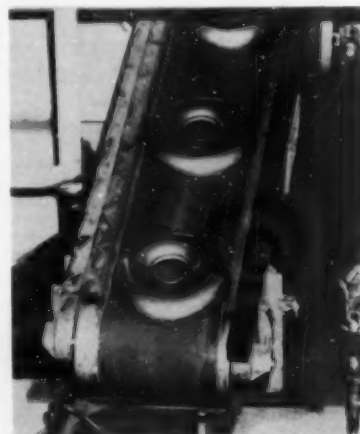
Progress in Production

sulated in epoxy, making them impervious to corrosive hydraulic oil, water and weld flash grit.

MAGNETIC RAILS END PARTS PILE-UP AT PRESS

An Eriez nonelectric magnetized rail assembly has put an end to parts pile-ups at a progressive die press in Ford's Sharonville plant. As stampings move from the press, magnetic rails, acting through a moving belt, pick them up as soon as they come into range. At a rate of 28 per minute, the belt moves the parts to the discharge point.

At the end of the conveyor the parts are automatically released and drop to the upper surface of another magnetized



Permanent-magnet rails hold stampings in contact with belt conveyor.

conveyor. Here they are held in fixed positions as they travel down a steep incline to subsequent operations.

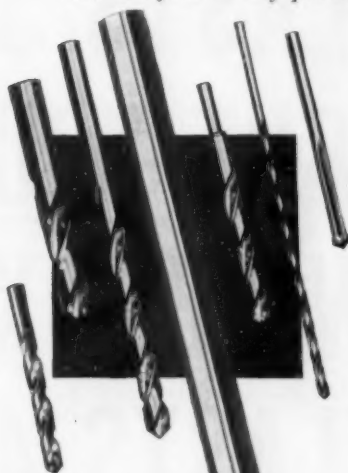
The rail unit can be assembled with new or existing conveyor systems and requires no outside source of power to convert these systems into elevator conveyors.

RADIATION MEASURED BY REMOTE CONTROL

A nuclear instrument bridge makes possible the automatic handling of "hot" materials such as those being tested for use as shielding materials in future atomic-powered planes. The bridge, developed by the Mechanical Div. of General Mills, spans two 30-ft-deep water pools located end to end and separated by a center wall.

By remote control, the mast of the bridge positions radiation probes or de-

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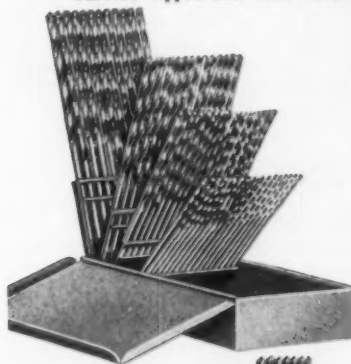


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testing instruments in either pool. The automatic positioning system, which has an analog-to-digital encoder, can be preset to automatically move the mast to any position in the pools.

The entire unit, weighing 30 tons, moves over precision-machined rails made of Allegheny Ludlum stainless steel Types 310 and 405. All contact surfaces on the rails, equipped with integral racks, have a 30-microinch finish.

NEW DIMPLER OPERATES IN ONCE INACCESSIBLE AREAS

A 6-lb two-stage portable dimpler is now operating in areas formerly inaccessible to ram-coined dimpling equipment. Developed by the Boeing Aero-Space Div., the hydraulically operated dimpler has a tool steel mandrel instead of the conventional C-yoke. The



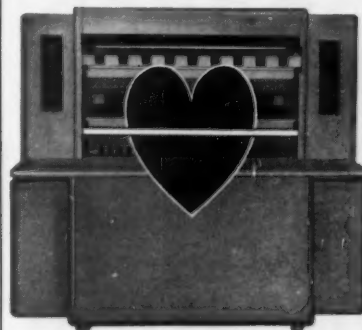
Portable hydraulic dimpling machine eliminates need for removing airframe skins in final assembly or repair.

mandrel, with a yield strength in excess of 230,000 psi, withstands forming pressures of several tons.

A clamping assembly slips onto the mandrel from the inside of the work piece to be dimpled. The split-nut collet chuck on the clamping assembly permits high-tensile loading by engaging shallow threads on the mandrel. The unit produces a clamping force in one direction and a forming force in the opposite direction.

At Boeing, the tool has been used to form dimples for $\frac{5}{32}$ to $\frac{1}{4}$ -inch-diam fasteners in 0.020 to 0.064-inch-thick 2024-T4 aluminum alloy.

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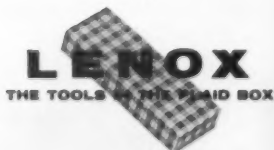
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Users of band-saw blades are switching to the new LENOX ALLOY STEEL MASTER-BAND. A proven cost saver, the MASTER-BAND lasts longer than regular blades; enables you to cut many of the tougher steels on standard equipment. Performance reports from trial-order users across the nation prove that the MASTER-BAND, usable on both standard and automatic machines, is consistent, reliable, fatigue resistant, outlasting 4, or more, carbon bands. Widths are currently $\frac{3}{4}$ " and 1"—others being added.

Prove MASTER-BAND performance to yourself. For a trial order, send us blade specs, machine make and model, diameters of materials cut.



Reports from manufacturers of bearings and gears, machinery, and other metal products show that the MASTER-BAND is the answer for their specific applications.



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.....reader's viewpoints

... knurling

To the Editor:

Recent experiments conducted in our machine tool laboratory have provided a new approach to knurling operations. Because of the widespread interest in this machining operation, many readers of THE TOOL ENGINEER will be interested in our results.

Generally, the explanation advanced for poor knurls is that the knurling rolls are dull. By an analysis of the operation, it can readily be seen that dull rolls are not the cause of poor knurls. Knurling is essentially a swaging operation—not a cutting operation. Of more importance is the lathe setup, feeds employed and lubricant.

In setup, it is important that the knuckle be centered so that equal force is applied to each roller. Faces of the rollers should be absolutely parallel to the workpiece axis.

If knurling is to proceed from right to left, the rolls should be engaged about one inch from the starting point. The carriage should then be cranked to the right to the position where the knurl is to be started. While moving the carriage rapidly, the operator should force the rolls deeper into the work.

When correct depth has been reached, the feed should be engaged. Lubricant, of course, is mandatory. Feeds should range from 0.010 - 0.015 ipr for high-carbon steel to 0.012 - 0.030 ipr for low-carbon steel. Greater feeds should be used for softer materials.

Speeds in surface feet per minute should run from 30 fpm for high-carbon steel to 60 fpm for low-carbon steel. A surface speed of 125 fpm should be used for nonferrous metals such as brass.

Adherence to the procedure outlined should eliminate double-cut surfaces.

E. W. Herman
Purdue University

... rehabilitation

To the Editor:

I have just had an opportunity to read your article, "ASTE Helps Prisoners," in the January 1960 issue of THE TOOL ENGINEER...

The story is worthy of a wide circulation, for it shows how citizens in the community can be of help in a most practical way in redirecting the lives of young people who have become involved in delinquencies.

James V. Bennett
U. S. Dept. of Justice

... rotating tail stock

To the Editor:

This letter is written in the hope that the Editorial Staff or the Society membership can assist me in locating manufacturers of a certain type of machine. This machine is basically a single-spindle automatic screw machine with a special head on the tail stock. Bar stock is fed through the head by conventional feed fingers and is gripped by the chuck. The cross slide tools work on the piece. The stock is then fed forward and goes into the special tail stock head. This head grips the work in a chuck and rotates it at a speed equal to that of the head stock. Because of this regripping of the work, it is possible to machine the cutoff end of the workpiece.

I believe machines of this type were originally developed to cut off rollers for roller bearings without leaving a tit on the cutoff end. However, I haven't seen one for years and possibly they're no longer manufactured.

Your help will be appreciated.

W. J. Sorrow
General Electric Co.

The Editorial Staff is unfamiliar with machines of this type. If any of our readers can help out, we'd like to hear from them. Ed.

... surgical tooling

To the Editor:

I have been giving some thought to the problem of making the artery clamp described in your article "Tooling for the Handicapped" in the June issue. Here for what they are worth, are several possible methods by which the clamp could be made. Each method has as its goal the making of a coining die which would be used to make the rows of teeth on the two halves.

The first method of making the die would utilize a pantograph duplicating milling machine which would reproduce the teeth from a wood model.

The second method would make use of an electrical-discharge machine to machine the teeth.

A third method involves making an impression which would then be used to cast or form the die. The impression could be made by using flat material and with a vertical mill and an index table machine the shape of the slots. This material would then be formed to the radius desired. Using hydraulic pressure to form it against a cavity may help to prevent deforming the slots. This impression could be used in several ways to make the die steel, one being to make it an investment casting.

Emerson Colopy
Lockport, N. J.

PERFORMANCE REPORT ON
LENOX
Master-Band
ALLOY STEEL BAND SAW BLADE

BEARING STEEL 52100
TYPE OF MATERIAL CUT

AUTOMATIC CUTOFF
TYPE OF MACHINE

3359 AVERAGE
SQUARE INCHES OF CUTTING

12'X1"X.035X67A
BLADE SPECIFICATIONS

YES
BLADE CUT BETTER & STRAIGHTER

YES
STRONG WELD

YES
LASTED LONGER

YES
RECOMMEND ORDERING MORE

The Norma-Hoffmann Bearings Corporation of Stamford, Conn., reports that in trial-order tests the LENOX ALLOY STEEL MASTER-BAND saw blade cut more than 3000 square inches of steel on automatic equipment. As a result of these tests, the company, which manufactures precision ball, roller, and thrust bearings, will use the MASTER-BAND for its production cutoff work.

Users across the country report similar results on both standard and automatic machines.

Machines for which the MASTER-BAND is designed include Johnson, Laidlaw, Marvel, Kalamazoo, DoAll, Napier, Grob, Wells, W. F. Wells, Milband-Thompson, and Peerless.



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DIVISION, Union Twist Drill Company, Derby Line, Vt.

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TOOLS

High-Speed Lathe

Controls, feeds and speeds, and principles of design of this 16-inch lathe are predicated on specialization. Designed specifically for high-speed turning, facing and boring operations, the machine has no gearbox or threading equipment. Minimum skill and time are required for operation. Infinitely variable speeds and feeds are dial-controlled. Maximum speeds are available to 2500 rpm, with a 4.4:1 reduction available for heavier cuts at low speeds. Power feed to carriage and cross slide vary from 0.079 to 24 ipm.



Feed per revolution can be varied from 0.0001 to 0.488 inch. Specifications include 16½-inch swing over ways; center distance of 30, 42 and 54 inches; standard spindle speeds of 50 to 1500 rpm; and variable spindle motor speed of 6.5 hp, d-c.

Barber-Colman Co., Rockford, Ill.
Circle 401

Induction Hardener

Low or high-frequency operation is possible with the three-position work station of this heat-treating unit. Equipped with a two-position low frequency of 450 kc, the single position higher frequency output is from 2 to 7 mc. The machine has dual facilities

for oil and water quench mediums and can be used as a reservoir for either oil or water recirculating systems or for drop quench systems. The left side

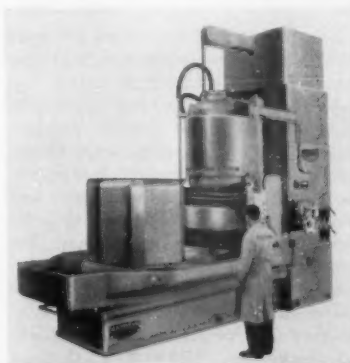


of the table is equipped with a pop-up spindle for rotating, raising or lowering the work in and out of the heating section.

Induction Heating Corp., 181 Wythe Ave., Brooklyn 11, N. Y. **Circle 402**

Rotary Surface Grinder

One setup handles rough and finish grinds of extra-large parts on this vertical rotary grinder that has a choice of 60 to 72-inch magnetic chucks. Approximately 125 hp is applied through the spindle, giving higher productivity

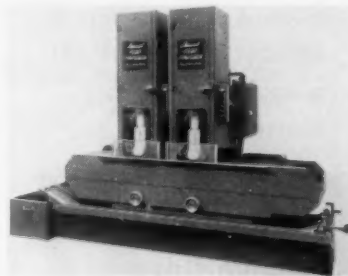


than is possible with less massive machines. Parts can be machined with a hogging cut to within a few thousandths of final size, grinding with the leading edge of the tilted wheel to increase grain penetration, then finish-ground in the same setup with the wheels in the flat position. Grinding wheels are available in sizes of 32, 36 and 42 inches.

Mattison Machine Works, Rockford, Ill. **Circle 403**

Finishing Machine

Flat work that is difficult to finish by hand can be easily done on this 12-inch flat finisher. The single or multihead machine, also available in 6, 8 and 10-inch models, does wet abrasive belt grinding, polishing and deburring of flat work such as sheets, bars, strips, stamping, plates and extrusions. Features of the machine include two-roll head design, air tensioning on head belts and conveyor belt, screw feed adjustment for depth of cut graduated in



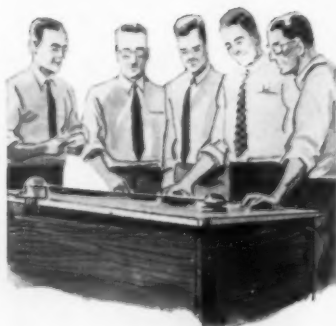
0.001 inch and variable speed conveyor drive from 0 to 60 fpm. Permanent or variable density magnetic platens and power elevation for each head are available as extra equipment. Tooling is reduced to a minimum through use of various types of conveyor belts, work hold-down rolls and magnetic platens.



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TOOLS of today

Use of the components simplifies changing from one job to another, minimizing downtime and setup cost.

Hammond Machinery Builders, Inc.,
1600 Douglas Ave., Kalamazoo, Mich.
Circle 404

Paint, Filler Applier

Model FPW-40 will apply paint and dial fillers to depressed numerals, letters and calibration markings, with subsequent wiping and polishing, at



rates of 2000 pieces per hour. Loaded parts travel into the masking station for application of filler by automatic spray guns. The next station prepries the filler while it is still wet, permitting an even flow into indentations and eliminating a powdery effect or caking. Parts are force-dried before indexing under the polishing head. Installation of the machine requires only connection of exhaust facilities, compressed air and electric power source.

Conforming Matrix Co., 381 Factories Bldg., Toledo 2, Ohio. Circle 405

Spot Welder

Especially suited for joining problems with electronic components such as semiconductors, printed circuit boards and foil-wound transistors and capacitors, this ultrasonic spot welder provides double welding capacity with no increase in generator input. A self-turning circuit assures weld uniformity and minimizes need for operator skill by automatically adjusting welding frequency to optimum value for the materials and thicknesses being joined. The welder can be used for joining similar or dissimilar metals of equal or different thickness. Thickness of the top

piece may be as much as 0.006 inch. There is no limit on thickness of the bottom piece. The ultrasonic process produces negligible heat and requires only light clamping pressure. The joint



is electrically conductive and mechanically stronger than the metals joined. The 100-watt generator operates on 50-60 cycle, 115 volt, a-c. Nominal output is 40 kc. An automatic weld timer is variable between 0.1 and 5 seconds. Operation is by foot or limit switch. The welding head is supplied for bench mounting or can be built into handling or assembly machinery.

International Ultrasonics, Inc., 1697 Elizabeth Ave., Rahway, N. J. Circle 406

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239 TO REQUEST ADDITIONAL TOOLS
OF TODAY INFORMATION

Portable Radiant Heater

Metals such as titanium, magnesium, inconel and molybdenum and their alloys can be raised to forming temperatures at the location of the drop hammer or press when this portable heater is used. Use of the heater eliminates rejects that result when metal ductility is weakened through heat loss during transfer of blanks from remote ovens



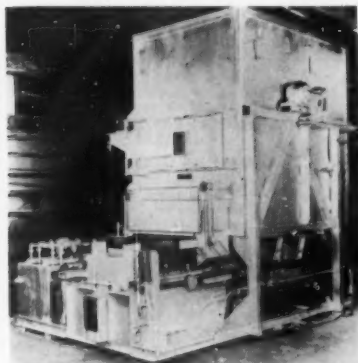
to forming facilities. The unit's retractable lamp head holds up to 99 infrared quartz bulbs and delivers temperatures up to 1500 F at the forming block, eliminating the need to heat soak blanks. Operated by remote cable controls, the lamp can be raised or lowered, extended and retracted over the workpiece.

The Electric Hotpack Co., Inc., 5026-A Cottman St., Philadelphia 35, Pa. Circle 407

The Tool and Manufacturing Engineer

Wash and Draw Furnace

Small parts can be washed and drawn at a rate of 1000 parts per hour with this automatic, gas-fired furnace. The

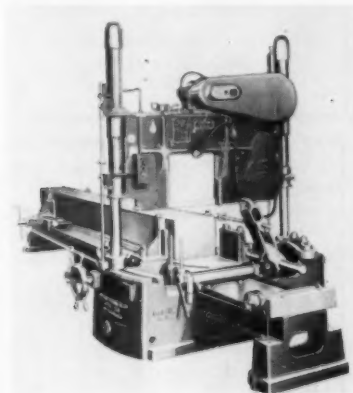


unit can process one basket of small tools or parts every 7½ minutes—a total of eight baskets per hour. The furnace operates at a draw temperature of 800 F with a maximum temperature to 1200 F. Elevators and conveyors are automatic. Solution in the washer circulates at a rate of 100 gpm.

The Waltz Furnace Co., 1901 Symmes St., Cincinnati, Ohio. **Circle 408**

Hydraulic Hack Saw

At speeds ranging from 35 to 165 spm, this No. 18 hack saw cuts angles



up to 45 deg without swinging the work. Pump of the low pressure hydraulic system operates only when housing is being raised to reload the machine. The blade frame is totally enclosed. Blade return relief is accomplished by raising only the saw frame, eliminating housing lift on every stroke.

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago 39, Ill. **Circle 409**

Diamond Tool Lathe

Turning capacity of a large size Bryant-Symons lathe is 13¼ inches diam by 12 inches long. Facing capacity is 21 inches diam by 12 inches wide. Distance between centers is 27 inches. The machine is most frequently used for nonferrous metal machine components, but can be used for other metals. It can be used with diamond, ceramic or carbide tools and produces finishes of less than one microinch. Spindle speeds range from 300 to 1200 rpm, with automatic feeds of 0.0005 to 0.0025 ipr.

Milo Mfg. Co., 259 N. Broad St., Elizabeth, N. J. **Circle 410**

Vibratory Finisher

Controlled, positive elliptical movement of the work container provides rapid finishing without impingement damage to workpieces in this tub type vibratory finisher. Positive amplitude is variable from 0 to ¾ inch, generated by mechanical cam action and easily



adjusted without disassembly of the unit. Once adjusted, the amplitude does not vary. Frequency range of the motor is 700 through 1800 cpm. The finisher is available in capacities of 1, 5 and 10 cu ft, with larger sizes on special order.

M-F Equipment Co., 410 Frelinghuysen Ave., Newark 12, N. J. **Circle 411**

Vertical Milling Machine

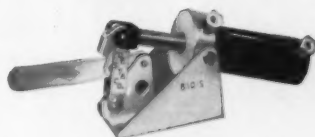
Holding of the workpiece by bolt or clamp is eliminated by the built-in electromagnetic table of this vertical milling machine. A d-c rectifier with manual reversing switch demagnetizes the table, workpiece and accumulated chips, making it easy to remove the work and keep the table clean. Automatic demagnetizing is available. The table has a 7 x 27-inch work surface

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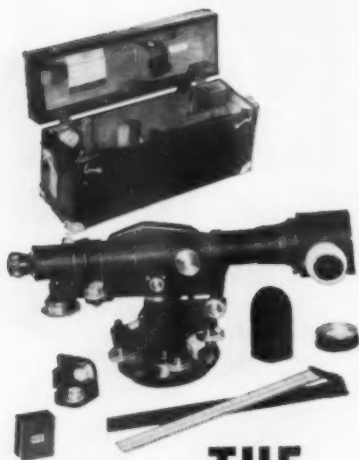
Clamping and unclamping are both actuated by normal air line pressure of 90 lbs.

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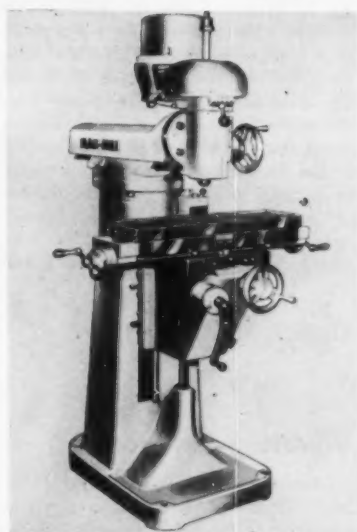
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TOOLS of today

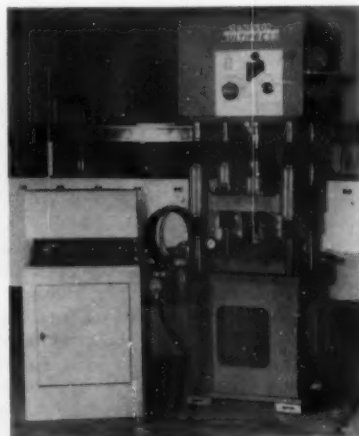


and 3 T-slots $1\frac{1}{16}$ inch wide and $2\frac{1}{8}$ inches apart. Longitudinal table travel is 16 inches, cross travel is 8 inches, vertical knee travel is 15 inches and vertical quill travel is 4 inches. Distance from spindle nose to table is $15\frac{1}{16}$ inches.

Hanchett Magna-Lock Corp., Big Rapids, Mich. **Circle 412**

High-Speed Stamping Press

Capable of delivering over 600 spm, this 25-ton hydraulic press is designed for high-speed, progressive stamping operations. The vertical frame, four-column platen press is equipped with roll feed, stock oiler and variable speed straightener. The lead area between guideposts is 20 x 20 inches. Pressures, as well as number of ram strokes, can be changed while the press is operating.



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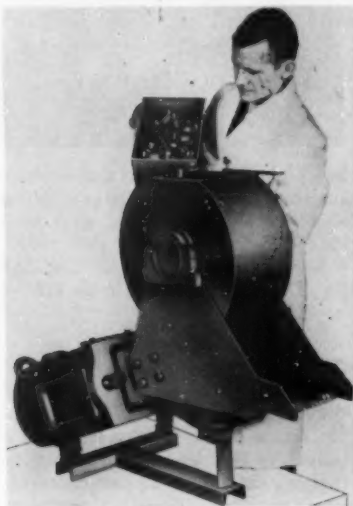
The Tool and Manufacturing Engineer

Feed control is servo sequenced to changes in ram stroke. The press has cam drives for work strokes of $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2 and 3 inches. Cams can be changed to provide special work strokes. Punch breakthrough is adjustable and controlled without positive stops.

Denison Engineering Div., American Brake Shoe Co., Columbus, Ohio. **Circle 413**

Vibratory Barrel Tumbling Machine

Deburring, cleaning, descaling and other finishing operations can be done with this barrel tumbling machine powered by electromagnetic vibration. Controlled, directional vibration keeps both parts and media working constantly and



provides thorough working of remote or shielded areas. Amplitude of vibration is instantly variable while maintaining a frequency of 3600 vibrations per minute. These models of the machine have barrel capacities of 0.4, 1 or 6 cu ft respectively. Parts handling is reduced by a screen cover and hose connection for flushing out compounds and a screen trough to separate the parts and media.

Syntron Co., 430 Lexington Ave., Homer City, Pa. **Circle 414**

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Threading, Turning Lathe

Single point carbide threading tools mounted on a cross slide that rests in a longitudinal slide are used in the Model FT-80 lathe. Both slides are supported by a saddle and carriage.

September 1960

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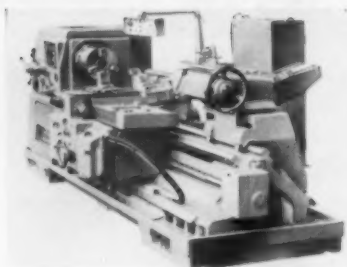
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TOOLS of today



Tool infed and number of passes are preset. Turning is accomplished from a separate turning saddle with its own ways and self-contained drive. An in-

dependent, template-controlled tracing cross slide is saddle-mounted. The tracing or turning cycle is automatic and allows for multiple tracing passes.

Gisholt Machine Co., 1245 E. Washington, Madison 10, Wis. **Circle 415**

Press Unloader

Attached to the crown of a press and operating at speeds up to 40 spm on 45-psi airline pressure, a swing arm type unloader will remove stampings from presses. Electrically controlled by the press, the arm provides a vertical lift for stamping with a smooth, nondipping unloading stroke. The unloader's low-inertia jaw assemblies—

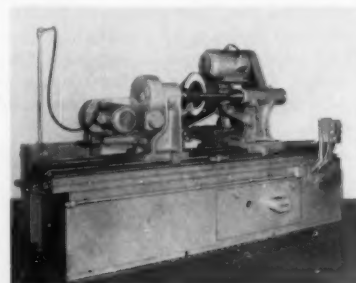
standard jaw, vertical flange jaw, chisel jaw and Vac-Hand—fit the manufacturers small, medium or large swinging arm.

Press Automation Systems, Inc., 25418 Ryan Rd., Warren, Mich. **Circle 416**

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Polishing Machine

Shafts and rolls up to 32 inches in diameter and 72 inches in length can

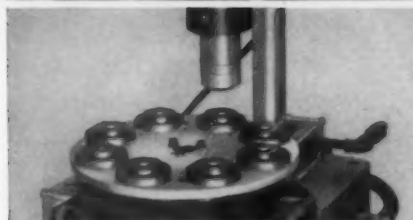
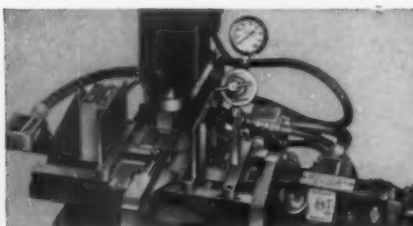
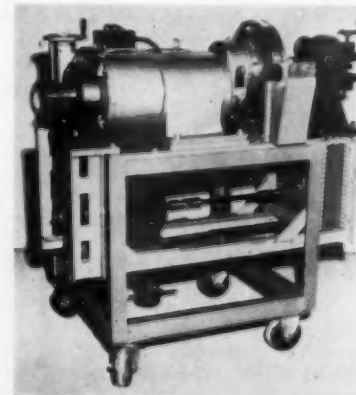


be polished or buffed to a 2-microinch surface finish with this lathe type machine. Spindle drive and work table speeds are variable.

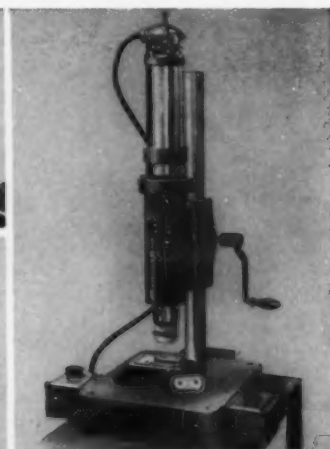
Acme Mfg. Co., 1400 E. Nine Mile Rd., Detroit 20, Mich. **Circle 417**

Plastics Cutter

Pinch-roll take-off synchronized with the action of the cutting blade is a feature of the Model IV-S cutter for use with extruded plastics, rubber and other materials. The unit has a redesigned Series 200 Reeves 1½-hp variable speed motor that is synchronous to maintain the predetermined speed despite voltage fluctuation. The pinch rolls, driven from the regular cutter motor through a variable speed transmission to adjust length of cuts and



ABOVE, TOP: 10T with stacker feed marks 3000 to 3600 nameplates per hour.
ABOVE, BOTTOM: 10T with dial feed marks 2400 to 3000 metal caps per hour.



ABOVE: Model 10T, Pneumark Bench Press with 10 ton capacity, available as automated or hand fed machine. Adaptable to a wide range of marking applications.

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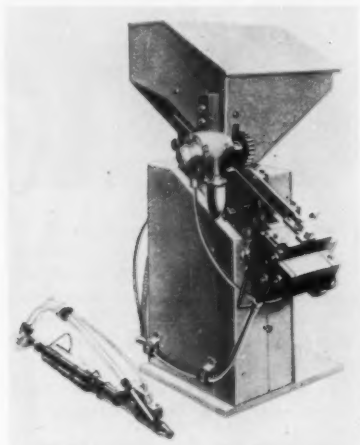
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through nonslip timing belts, can be used to replace the take-off unit on extruding machines, as well as to control the feed to the cutter. The pinch-roll take-off is also available separately, without drive, for use in a variety of feeding or pulling operations.

Foster & Allen, Inc., 26 Commerce St., Chatham, N. J. **Circle 418**

Automatic Screw Feeder-Driver

Adaptable to all standard pneumatic and most electric screwdrivers, the JS-60 automatic screw feeder-driver is easily portable and can be connected to any adequate air line. It can be used with screws from No. 2 through No. 14

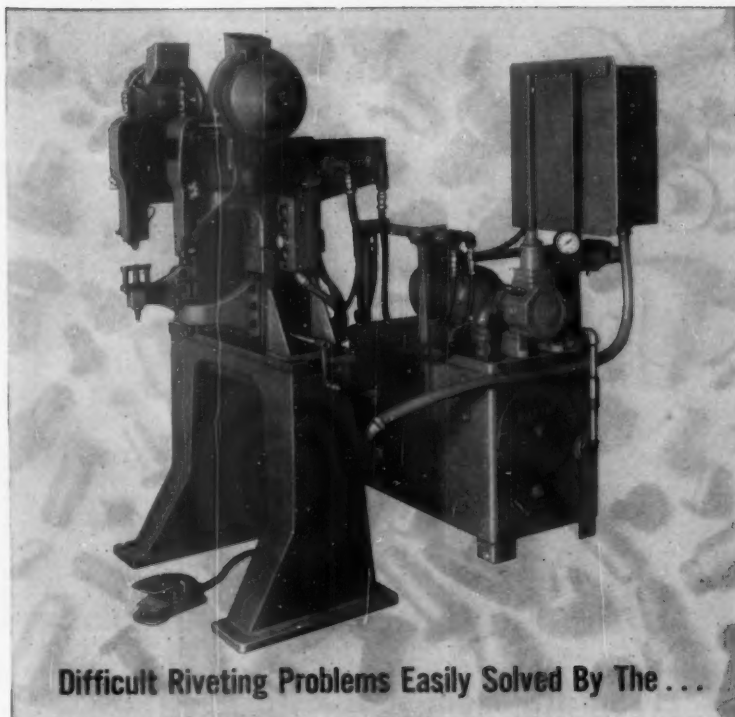


and is convertible to drivers such as Phillips, slotted, hexagon or clutch, with any head style. The unit will feed and drive preassembled fastener-washer combinations.

Parker Kaylor Div., General American Transportation Corp., 1 Peekay Dr., Clifton, N. J. **Circle 419**

OBI Press

Largest of a new line of open-back, inclinable presses is the 60-ton model illustrated. Others in the C-series have capacities of 22.35 and 45 tons. The meehanite frame provides 50 percent less deflection at full tonnage than previous models, giving a higher degree of parallelism between punch and die and affording a greater number of pieces between die grinds. The press provides high uniformity of front-to-back pressure for bottom forming and flattening work. Bed opening, space between uprights and throat depth are all larger than previous models. Crank-



Difficult Riveting Problems Easily Solved By The ...

New T-J HYDRAULIC DUAL RIVITOR

With Increased

Riveting Production • Quality • Versatility

Added recently to the versatile T-J line of unit and production line riveting and clinching machines is the new Hydraulic Dual Rivitor. The Model HDR will set two ¼" solid steel rivets at once with adjustable spacing from 1½" to 18" maximum, center to center, being fed from 10" hoppers. Operating cycle is approximately .8 second, at 420 P.S.I. oil pressure furnished from a hydraulic power unit with maximum of 1000 P.S.I. output. For complete specifications write to The Tomkins-Johnson Co., 2425 W. Michigan Ave., Jackson, Michigan for Bulletin HDR-4-59.

For information on other T-J Rivitors and Clinchers write for Bulletin No. 555.



Use Reader Service Card, CIRCLE 89

To prevent corrosion and anchor paint on aluminum

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



Protect aluminum at lowest unit cost with CHROMICOAT conversion coatings

Oakite CHROMICOAT is an economy any way you look at it: on the basis of price alone . . . on solution make-up and "mileage" . . . on the way it blocks corrosion and forms a perfect anchor for paint to keep your customers sold and satisfied.

This is a conversion coating you can depend on. Oakite ChromiCoat protects for hundreds of hours under the ordeal of salt-spray tests . . . and surpasses MIL-C-5541 specs *several times over!*

And the Oakite process is simplicity itself. No control problem. A thin, golden, uniform coating every time.

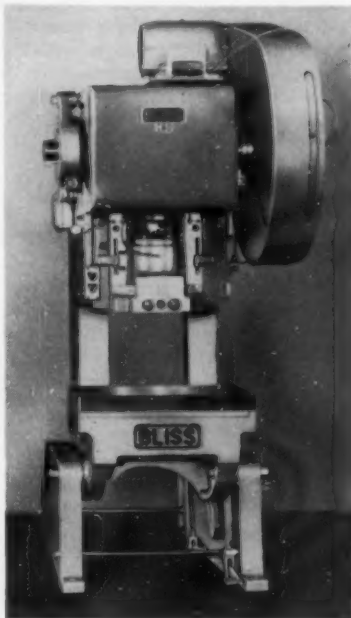
ChromiCoat is just one of a line of more than 30 Oakite materials designed especially for aluminum. There are etch and non-etch cleaners . . . barrel finishing compounds . . . safe paint strippers . . . forming lubricants.

For more information, ask your local Oakite man or write to Oakite Products, Inc., 45B Rector Street, New York 6, N. Y.

it PAYS to ask Oakite



TOOLS of today



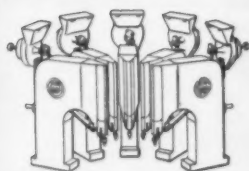
shaft diameters are from 25 to 30 percent greater at the crankpin. Slide adjustment is longer, locking is easy and connection is strong. The portable inclining mechanism of all presses in the line is of either worm gear or ratchet type. Combined, compact controls provide settings for continuous or single stroke operation. Air friction or mechanical clutches are optional.

E. W. Bliss Co., 1375 Raff Rd., SW., Canton 10, Ohio. **Circle 420**

Brazing Alloys

Applications for a line of vacuum-melted, high strength, high temperature alloys include brazing of type 321, 347 and other stainless steels as well as the super alloys such as René 41. Three types of alloys are available. The wide gap series can bridge joint clearances up to $\frac{1}{16}$ inch, eliminating machining operations necessary to achieve the 0.003-inch clearance normal for other types of alloys. The general purpose alloys are for high-temperature brazing and the third variety is for brazing metal honeycomb assemblies containing thin core material. Vacuum melting provides a cleaner alloy, essentially free from inclusions, impurities, oxides and absorbed gases. The process permits close composition control and prevents loss of essential alloying elements.

Metallurgical Products Dept., General Electric Co., Detroit 32, Mich. **Circle 421**



**NEW
"BUILDING
BLOCKS"**
for automatic riveting

Model 56



**Milford's Models 56 and 57
offer unlimited flexibility
in automatic assembly!**

Group these new "Building Blocks" to suit your production needs. Use them singly, in pairs, in threes, fours or even fives. Write for more information on multiple riveting, the newest answer to reducing assembly costs.

For more new ideas, tips and technical data on tubular rivets and rivet-setting machines, ask your Milford Representative for a look at Milford's new **MANUAL OF MODERN RIVETING PRACTICE**.



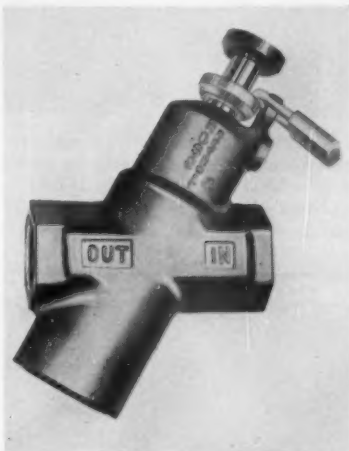
MILFORD, CONNECTICUT • HATBORO, PENNA.
ELYRIA, OHIO • AURORA, ILL. • NORWALK, CALIF.

Use Reader Service Card, CIRCLE 91

September 1960

Lock-Out, Exhaust Valve

Safety during repair, maintenance and shutdown periods can be increased on machines using compressed air by installation of this valve in the air supply line leading to the machine. Positioning is upstream of any operating valve and normally the air flow is directly through it. When the lock-out and exhaust valve is shifted, air to the machine is shut off and the air downstream is exhausted into the atmosphere. The valve can then be locked in the closed position with a padlock. If a closed-center valve is used in the circuit, compressed air can be trapped downstream of it. Additional lock-out and exhaust valves should be installed on each outlet port of the closed center valve. The valve provides for isolation and inactivation



of segments of air circuits, making a portion of the machine more safely available for servicing without interfering with other parts of the circuit. The valve has one moving part, is dented in the open position and designed for a minimum pressure stop. It is available in four sizes for $\frac{3}{8}$ to 1-inch pipe. The area through the valve is greater than the interior of the standard pipe for which it is tapped.

Ross Operating Valve Co., 120 E. Golden Gate Ave., Detroit 3, Mich.
Circle 422

USE READER SERVICE CARD ON PAGE 239 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Long Die Swaging Machine

Tapers up to 10 inches long can be produced in a single pass on tubing up to $1\frac{3}{4}$ inches in diameter with this

Use Reader Service Card, CIRCLE 92

AMERICAN

Experience

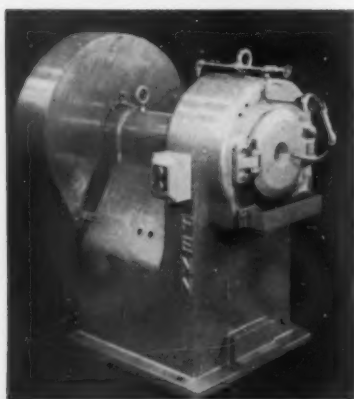
For 41 years the American Twist Drill Company has produced superior twist drills for precision mass production use of America's Automotive Industry. We expect these fine drills will be available to all industry soon. They will be worth waiting for!



American Twist Drill Co.,
Detroit, Michigan
Subsidiary of:
Cutting Tool Division
Brown & Sharpe Mfg. Co.,
Providence 1, Rhode Island

AMERICAN

TOOLS of today

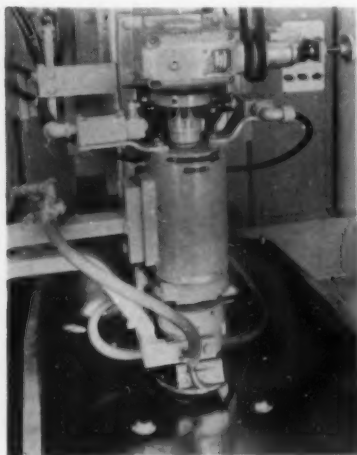


model 3 1/2 F machine. Longer tapers can be achieved through progressive die size changes. Model 4 1/2 F will produce tapers up to 15 inches long on tubing up to 2 1/2 inch diameter in a single pass at a production rate of approximately six tapers per minute. Both machines will accommodate welded and seamless tubing of ferrous and nonferrous materials.

The Fenn Mfg. Co., Fenn Rd., Newington, Conn. **Circle 423**

Seam Welder

Suited for handling ring welding jobs from 3/4 to 6 inches in diameter, this wobble head welder has an automatic time out and wheel return with speed adjustable to 6 rpm. A 1/4-hp motor



drives the wobble head through the gear reducer with cam initiation of the weld timer. The unit illustrated is mounted on a press type welder with 200 kva transformer and a 7-inch ad-

justable stroke cylinder. Typical uses for the wobble head unit include welding of filler necks and large drains to tanks, exchange tubes to header plates and flanges to large diameter thin-walled tubing.

Precision Welder and Flexopress Corp., 3520 Ibsen Ave., Cincinnati 9, Ohio. **Circle 424**

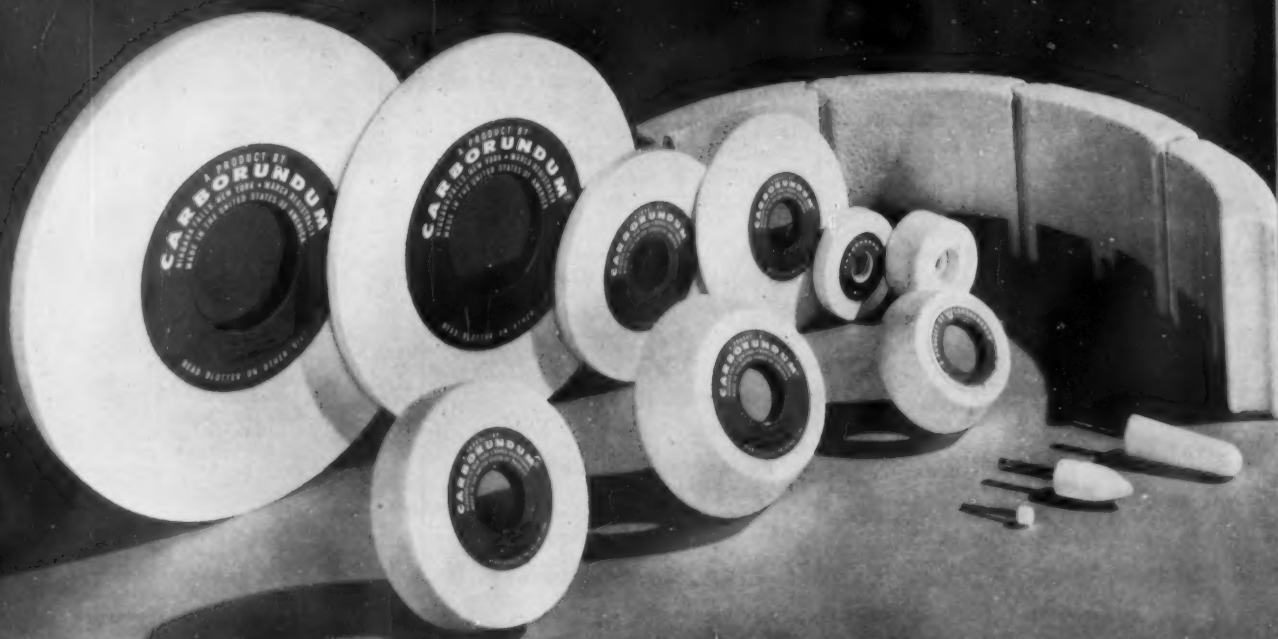
USE READER SERVICE CARD ON PAGE 239 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Drafting, Layout Aid

Used to determine coordinate measurements, a computing aid provides a fast, accurate means for laying out bolt hole patterns, electrical connector pin locations, and other drafting or scribing jobs requiring circular point patterns. The tool provides an instant reference for angular measurements, chord lengths, hole patterns, tangents and polygons. The X and Y dimensions of 3 to 50 equidistant points on a circle can be determined in two simple steps. Normal errors that arise from locating each point are eliminated.

Patterson-Harrison Instruments, P. O. Box 784, Everman, Tex. **Circle 425**

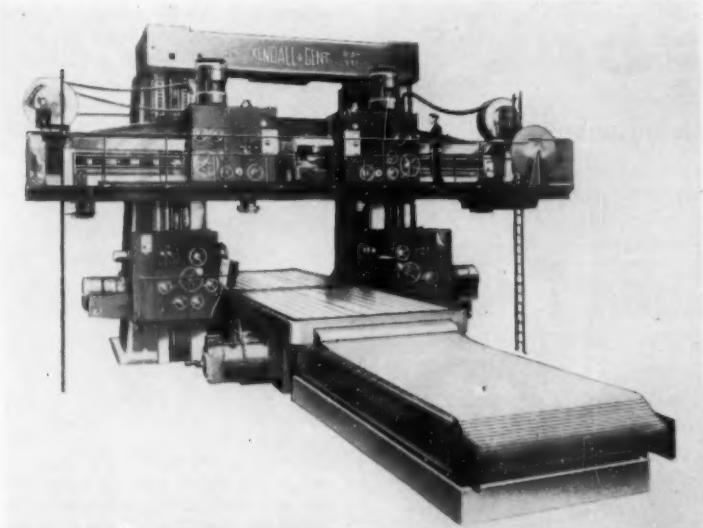
• V40 Bond Tool Room Wheels cut cool and fast



Milling Machine

Designed for machining large electrical components and steam turbine casings, this milling machine is 70 ft in

length and weighs 450 tons. Maximum size of the component which it can machine is 35½ x 12 x 9½ ft. Each



cross-slide carrying the two cutting heads is 45 ft in length and weighs 40 tons. Table and milling head traverses

are electronically controlled and provide an infinitely variable range of feeds from 1 to 50 ipm. The cutter can be steered by remote control around any shape of workpiece, permitting continuous metal removal and reducing machining time.

Sykes Machine & Gear Corp., 744 Broad St., Newark 2, N. J. **Circle 426**

Square End Cylinders

Double-acting pneumatic and hydraulic cylinders have full floating, two-stage cushions that provide smooth deceleration of the piston. Cushions are fully adjustable, unlikely to be damaged by impurities in the working medium and provide rapid and smooth advance of the rod without use of ball checks. The cylinders are available in bore sizes of 1½, 2, 2½, 3¼, 4, 5 and 6 inches. Maximum air pressure is 250 psi for all bores. Maximum oil pressures are 100 psi through 3¼-inch bore; 700 psi through 5-inch bore; and 600 psi on the 6-inch bore. Cylinders for use with water can be supplied. All mountings of the 13 available styles are dimensionally interchangeable with

V40 BOND WHEELS

ARE AVAILABLE

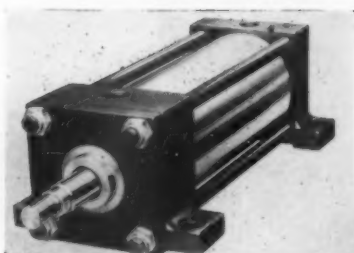
for all tool room grinding operations

Here's a complete line of tool room wheels that will do a wide range of work on die steels and high speed tool steels. These wheels cut cool and fast. Heavy infeeds can be taken without burning the material. Their superior form-holding ability eliminates costly stops for dressing halfway through a job. Yet, when dressing between jobs, the special vitrified bond composition permits faster, easier dressing with substantial savings in time and abrasive.

V40 bond tool room wheels are available as NATIONAL STANDARDS by Carborundum for simplified ordering and inventory control. Ask your local distributor for recommendations to meet your specific requirements. He carries a stock of many of these popular wheels for immediate delivery.

CARBORUNDUM

TOOLS of today



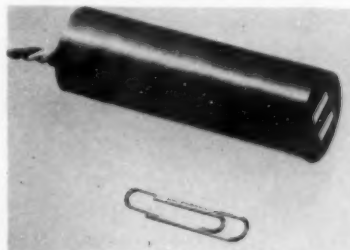
standard JIC square end cylinders. On most models, the pipe port and cushion adjustment location may be customer-selected. Temperature range of air models is to 212 F; of oil models, to 250 F; and special-order cylinders will handle temperatures to 400 F.

Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill. **Circle 427**

Proximity Switch

Applications for this proximity switch that performs like a standard

limit switch include machine beds and ways, air and hydraulic cylinder ends, checking devices, rotating cam timers and installation in die faces and fixtures. The switch can be integrally mounted within or flush to the machine or device. It can be actuated by objects traveling either axially or tangentially. It can also be keyed to a selected contour or an oriented magnet as the actuating device, to permit switching across a larger gap without loss of reliability.



The switch has an OD of $1\frac{3}{16}$ inches and is $2\frac{1}{2}$ inches long. It has snap action and repeatability within 0.001 inch. Differential between on and off position is approximately 0.008 inch. Coil spring loaded, the switch maintains high constant pressure and cannot dwell between on and off position.

Tann Controls Co., Div. of Tann Corp., 3750 E. Outer Drive, Detroit 34, Mich. **Circle 428**



Dies cost less to build, less to buy

when you specify

RING Punches and Dies



Check your in-shop estimates. Then check Ring prices. Figure the extra savings in reduced die assembly time ...and you will see how you can economize with Ring, yet retain quality.

RING or SOLID HEAD type punches in stock...round, oblong, square, rectangular, slug ejector, pilot, blank. All punch points ground to specified decimal sizes at no extra charge. Ring or press fit type dies from stock with hole sizes to proper clearance for the material to be punched. SPECIALS in choice of steels, to your specifications.

WRITE Dept. E for New Catalog of headed and Ring punches and dies, ejector punches, shoulder and bevel quills, and stripper guide bushings.



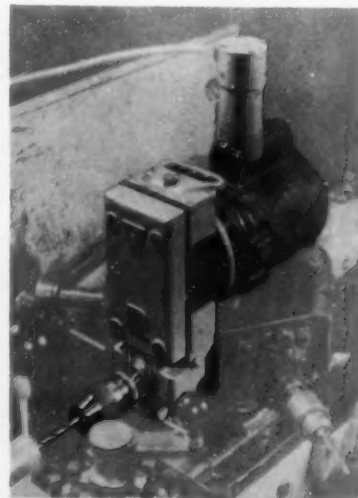
RING PUNCH & DIE DIVISION

OF THE PRODUCTO MACHINE COMPANY
JAMESTOWN, NEW YORK



Turret Lathe Drill Speeder

Operable with both ram and saddle type machines, this drill speeder has a tool steel capacity of $\frac{1}{2}$ -inch drill, No. 2 Morse taper. The unit has four speeds with two optional combinations: 340, 510, 625 and 945 rpm or 530, 865, 1045 and 1615 rpm. The rear of the



body casting mounts directly to the turret face, with the flanged mounting providing high rigidity. The drill speeder's short overhang takes up 4½ inches from the face of the turret to the end of the spindle. A swivel electrical connector permits the unit to rotate freely within the turret without tangling the lines. Model 3-201 uses a ¾-hp, 3-phase, 220/440-volt motor actuated by a foot switch. The unit fits the W&S No. 3 turret lathe, 3EC, 4 and 16-inch EC; the Gisholt No. 3 and 4; and the J&L No. 3 and 4 with adapter.

The Ward-Riddle Co., 241 Myrtle St., Ravenna, Ohio. **Circle 429**

Tool Presetting Gage

Compact circular type gage plates are supplied with from one to six holes. The six-hole plate is 11½ inches in diameter. The units can replace present plates in the manufacturer's tool control systems or can be used for presetting tools where operations are limited

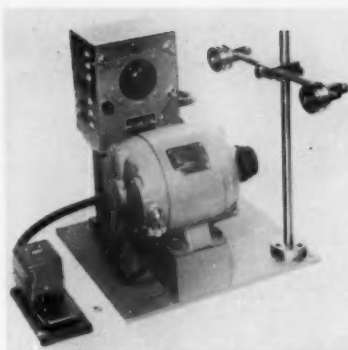


and do not require use of tool control boards. Gages furnished with the plates have hardened interchangeable heads. They are made in bar-height, chamfer, flush-pin, and flush-pin-with-indicator styles. The last can provide an indicator range of from 0.055 to 1 inch. Gages provide for a presetting range of from 3 to 21 inches.

Seibert & Sons, Inc., Chenoa, Ill. **Circle 430**

Motor Drive Unit

Speeds of from 0 to 4000 rpm are available with this electronic motor drive unit. It can be stopped or reversed

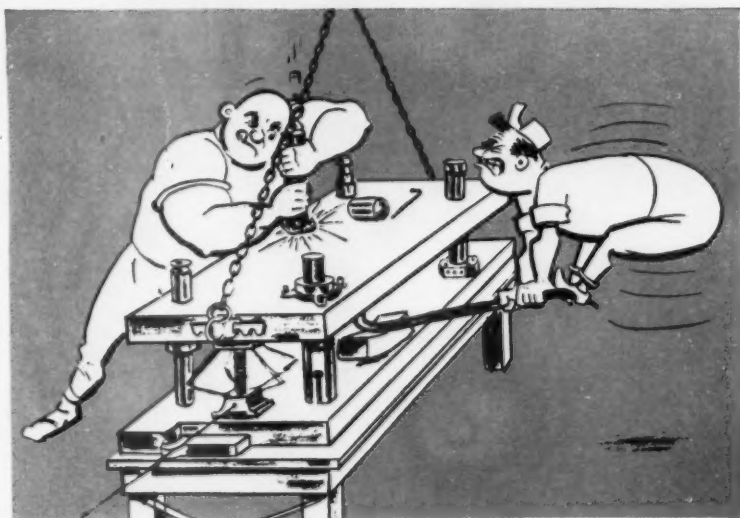


at any speed. A double shaft can be supplied to run the idler pulley and stand and lathe from the same motor. Units are available with ⅛ or ¼-hp motors that operate at 110 volts, 60 cycles, 1-phase a-c. The foot switch is included. Idler pulley and stand can be directionally adjusted as required and will follow travel of the tools being driven.

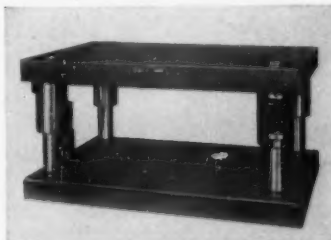
F. W. Derbyshire, Inc., 157 High St., Waltham 54, Mass. **Circle 431**

USE READER SERVICE CARD ON PAGE 239 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

DON'T KNOCK YOURSELF OUT WITH STICKY DIE SETS!



Dieco Ball Bearing Die Sets take all the strain out of die making!



NO PAIN...NO STRAIN...and it is extremely accurate! These precision die sets give you burr-free parts and longer production runs—thanks to their "negative clearance." (Cutaway shows how ball-bearing bushing rides on the pin.)

Try a Dieco ball-bearing die set on that next job; you will actually see the punch holder g-l-i-d-e on and off. Folks tell us working with Dieco is almost like taking a two-week vacation. It's that easy.

Management likes them, too. The pre-loaded bushing eliminates die shifting, protects the dies, and gives longer runs between grinds. These sets are assembled in the conventional way; pins are in the shoes. We will sell you complete sets, or just the components, so you can convert the friction bushing sets you now have.

dieco
DIE SETS

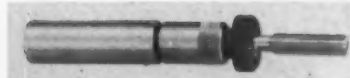
E. W. BLISS COMPANY
DIE SUPPLY DIVISION
1400 Brookpark Road
Cleveland, Ohio

Use Reader Service Card, CIRCLE 95

TOOLS of today

Tapping, Threading Tools

Leadscrews or hydraulic and mechanical feeds on automatic screw machines, multiple-spindle drilling machines and turret lathes are eliminated by use of a line of compact tapping and threading tools. Free movement of each tool's axial floating drive spindle allows taps and dies to determine their own lead without machine or operator pressure after engaging the workpiece. Length



of stroke is preset by the knurled cap. Instant re-engagement of the drive for retraction occurs when the machine spindle is reversed.

Tapmatic Corp., 845 W. 16th St., Costa Mesa, Calif. **Circle 432**

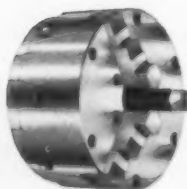
USE READER SERVICE CARD ON PAGE 239 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Only a rich man can afford old-style chucks!

**You make money
every time you
chuck with *Buck***



***Buck* gives you this.....**



*Dead true precision... .0005" precision
chucking duplicate parts... ends need for collets
... holds O.D. and I.D. true... takes up wear...
compensates for spindle run-out... and there's NO
PRICE PREMIUM!*

If you haven't yet put Buck Ajust-Tru® chucks to work in your plant there are big and profitable performance surprises ahead. Send for complete information. "It pays to chuck with Buck."

Makers of Scroll, Power,
Dust Proof, Independent
Chucks.

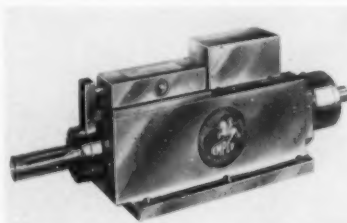
BUCK TOOL COMPANY

933 SCHIPPERS LANE • KALAMAZOO, MICHIGAN

Use Reader Service Card, CIRCLE 96

Hydraulic Feed Unit

Operating independently or in conjunction with other equipment such as clamps, indexing mechanisms and other feed units, this hydraulic feed unit simplifies control of complex machining operations. Pressure-compensated feed



valves permit a flexible range of operational cycles. Fine adjustment potential permits use of the attachment in reaming, counterboring, grooving, tapping and other applications requiring even feed. Drilling capacity in medium steel is 5/16-inch diam. with adjustable stroke up to 4 inches. Maximum speed is 3000 rpm with a 3/4-hp motor. Maximum hydraulic line pressure is 50 psi, with 7000 lbs of thrust for each 300 psi. Standard equipment includes a 3/4-inch inside diam spindle nose. Multiple head adapter is optional.

Enterprise Machine-Parts Corp., 2732 Jerome St., Detroit 12, Mich. **Circle 433**

Adjustable Boring Tool

Available in 18 sizes for boring holes from 3 to 13 1/4 inches, a line of boring tools eliminates the need for different tools for roughing, semi-finishing and finishing operations. The tool carries



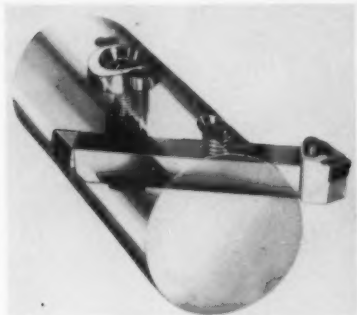
three standard square cutters in a single indexable head that is mounted eccentrically on an arbor so that only one tool is in a cutting position and the other two are clear of the bore. Indexing of one cutter to the next is done by loosening a clamping nut one half turn and rotating the head. This method

permits successive operations without interfering with the workpiece or removing the arbor from the machine spindle.

Davis Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. **Circle 434**

Disposable Carbide Inserts

Cutters with standard throwaway carbide inserts are designed for use in micrometer-adjustable tooling such as the manufacturer's stub boring tool sets, stub and line bars, multiple-cutter

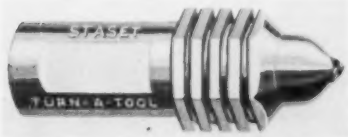


boring heads and extension boring heads. The disposable insert cutters are interchangeable with high-speed steel and carbide tipped cutters. In the latter, the cutter is adjustable in increments of 0.0001 inch with a direct-reading micrometer dial screw. For rough boring, the cutter can be set with a gage and dial-adjusted for semi-finish boring.

Davis Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. **Circle 435**

Wheel Dressing Tool

Turning of the entire tool from 0 to 360 deg within a fixed shank is permitted by this device designed to keep the diamond sharp, provide constant



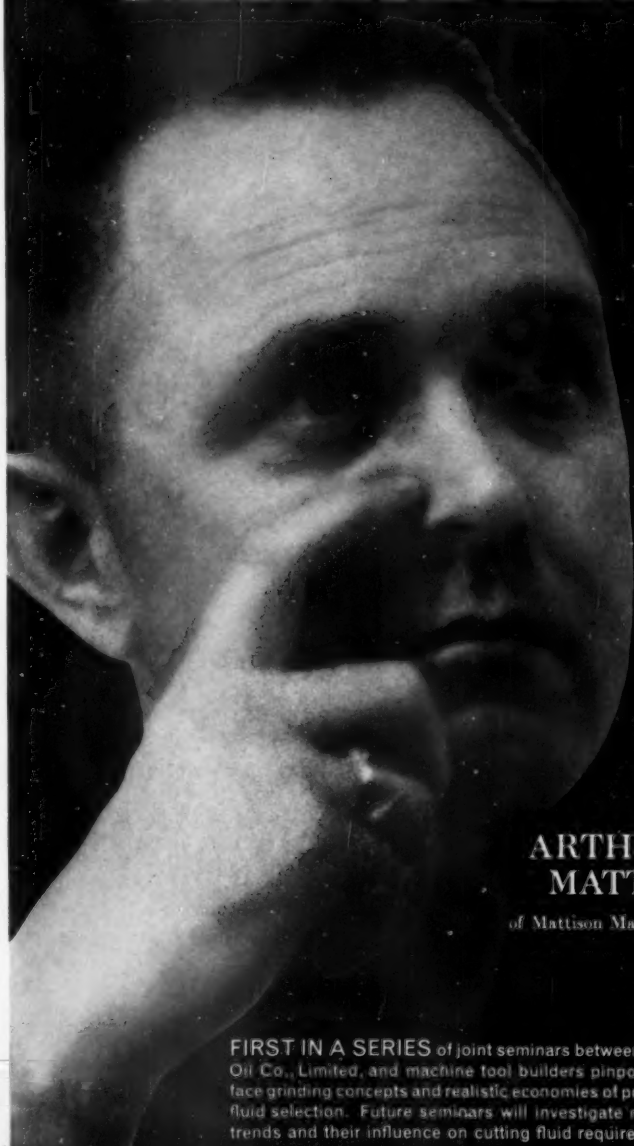
tension and eliminate wear at the bearing surface. Tension can be increased by additional flaring of the tool at the end opposite the diamond. The device can be applied to all diamond tools styles with any size diamond or diamonds.

The Staset Co., Inc., 66 Franklin Ave., West Orange, N. J. **Circle 436**

(Continued on page 219)

Use Reader Service Card, **CIRCLE 97** ➡

HARD WHEEL THINKERS IN SURFACE GRINDING



**ARTHUR M.
MATTISON**

of Mattison Machine Works

FIRST IN A SERIES of joint seminars between D. A. Stuart Oil Co., Limited, and machine tool builders pinpoints new surface grinding concepts and realistic economies of proper grinding fluid selection. Future seminars will investigate metal working trends and their influence on cutting fluid requirements.


turn the page

MATTISON pushes the process

Down in the shop . . . have you put an ear to the "shwwish" of sharp new grits cutting stock after the dull ones broke loose

. . . then cursed the rumble and groan of the grinder when only minutes later the wheel loaded up? Time was when these real sounds too often meant premature wheel wear or lack of detergency in the grinding fluid. Older wheels simply couldn't make the heavy cuts, and the "witchcraft" of choosing cutting fluids baffled the experts. But now, wheel improvements and proper grinding fluid selection can make the big *shwwish* a steady sound of profitable stock removal on machines like Mattison's new No. 60.

power, pressure,
AND porosity
FOR profitable
surface grinding



Grinding plants and cutting fluids are seminated by Mattison representatives, Stuart Division Manager George G. Spehn (kneeling), and Stuart Engineer Ronald J. Foitt (second from right).



Russel Holm, sales engineer—bear down on wheels and ease up on costs.

Mattison Machine Works, Rockford builder of surface grinders, is pushing horsepower hard. Objective: to advance surface grinding for heavy stock removal, as well as for accurate finishing. Up to 125 hp is applied to 20" wheels. High downfeed increases grain penetration and keeps wheels self-dressing. Results show high machine efficiency and low unit cost for pieceparts properly designed for the "Mattison concept."

William C. Knapp, sales manager—pulling the belt into the work produces a finer finish.



Grinding wheels are really throwaways

As Arthur M. Mattison, chief engineer, points out: "Aluminum oxide wheels are a neat package of hard, self-sharpening tool bits in throw-away form. Their ability to stay sharp, even under extremely heavy cuts, eliminates a major cause of machine downtime. And, hard materials present no tool breakage problem."

Today's hard wheels are right for the "Mattison concept." Vitrified bonds are so improved that now you get economical breakdown rates under extremely heavy loads. Not only that, grits are available in individually formed crystals (instead of pulverized particles). They fracture several times as they get dull instead of pulling out whole. Thus, wheels offer a greater number of sharp cutting edges which use new spindle power to penetrate deeply into most materials, without burning.

Chip clearance still a problem

Yet to be solved is the chip clearance problem. There isn't enough space between grits. With heavy stock removal, chips tend to fill the voids in the wheel. Ratio of stock removal to wheel cost drops drastically as a result.

How grinding fluids help

Here's where cutting fluids enter decisively into the economics of

grinding. Proper balance of lubricity and detergency improves efficiency, wheel life, and surface finish. The right amount of lubricity, such as in Stuart's Hi-D 106, produces full benefits from new abrasive grains which fracture and produce new cutting edges. Total lack of lubricity results in dulling and pulling out of the cutting edges before full value is received.

Heavy stock removal demands a grinding fluid with high detergency and surface wetting ability. Limited chip clearance demands active flushing so chips do not clog voids and cause loading.

Proper application is important

The importance of directing a heavy volume of fluid to the point of contact bears continued attention.



Arthur M. Mattison, chief engineer (left)—we lose flatness if the grinding fluid dries on the chuck.

A case in point, cited by Mattison engineer, Russel Holm, is a difficult disc-grinding job—removing 5 cubic inches per minute from 1045 carbon steel saw guides. After holes were provided in the wheel to improve the flow of grinding fluid, it was possible to use a grade 4½ times harder and boost stock removal. With cylinder wheels, the answer often is to pipe fluid through the center, or up through the work.

more next page



William C. Knapp—some plants prefer to use solubles because of cost, but their finishes could be better.

Variation in water prevents universal grinding fluid

With varying water conditions, it is not easy to formulate the "perfect grinding fluid." A fluid that leaves accuracy destroying deposits in the Midwest easily could produce foaming in the East. Rusting and lack of stability usually can be traced to specific water conditions. As a result, variations in formulation often are required to compensate for water. Generally, it pays to lean toward high detergency when grinding large, uninterrupted surfaces for which a free cutting wheel is most important.



Linsly Brown, sales engineer—light oil is superior for abrasive belts on aluminum—water tends to drag.

Abrasive belt grinding goes precision

Nowhere in grinding is there so much technical change as in the abrasive belt field. Mattison engineer, Linsly Brown, lives in a ground swell of new applications—and the high horsepower concept (they're using up to 150) is an important part of Mattison's thinking on every job.

Yes, power and rigidity are required to get positive grain penetration at belt speeds as high as 12,000 ft per minute, holding thickness tolerances of $\pm .001"$.



Linsly Brown (left)—steel companies are using ThredKut 99 to produce #4 finish on stainless.

Selection of grinding and polishing oils for abrasive belts

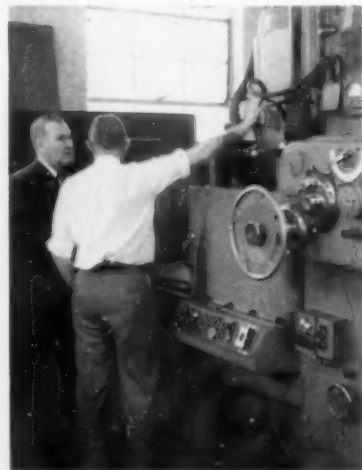
Selection of grinding fluids gets all knotted up in belt costs, finish requirements, material specifications, and methods of application. Most of the grinding cost is in the belts, and "wet" belts cost more than the "dry" paper type. So it is more economical to use oil-type grinding

fluids than water-mix types—and in most cases, they produce better finishes.

Straight oils usually work best with aluminum and stainless because bright, shiny finishes are required. For stainless sheet polishing, a sulpho-chlorinated oil, such as Stuart's ThredKut 99, has proved its superiority. For aluminum, a light viscosity oil with fatty lubricity additive, such as SuperKool 201M, produces best over-all results.

Methods available for application often make viscosity a selection factor. Generally, a heavy flow of oil is preferred. But, many jobs are performed successfully with spray lubrication or oil brushed on the work surface.

(For more information or reprints of this seminar, write to our Technical Service Department, located at the address below.)



Mattison rotary—the new 125-hp Quick-Tilt machine increases production 50%, or more. Cutting fluid must clean the wheel.

Productive Lubrication SEMINAR

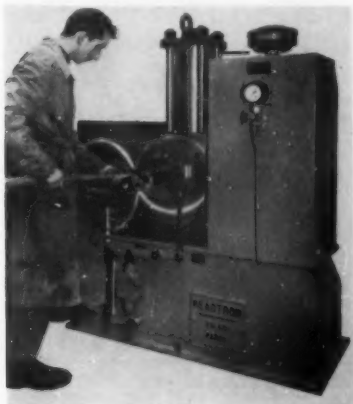
D. A. STUART OIL CO., LIMITED

2727 South Troy Street, Chicago 23, Ill. • Canadian D. A. Stuart Oil Co., Limited, P. O. Box 430, 43 Upton Road, Scarborough, Ontario, Canada

TOOLS of today

Bar Stock Shear

Built in three capacities for shearing up to 1, 2 and 2¾-inch round bar stock or any standard shape within these dimensions, this machine will cut bar lengths as short as ½ the diameter of the stock. Available with either hand

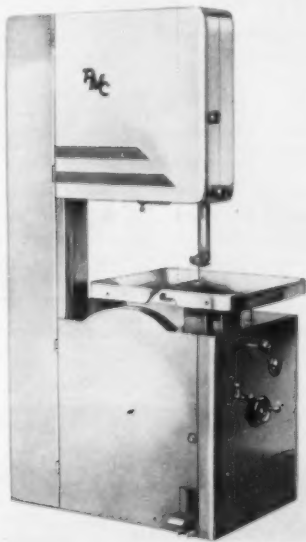


or automatic feed, the unit eliminates deburring and other secondary operations, gives long performance runs on tooling, permits fast tool changes, and cuts high-alloy refractory metals as easily as soft alloys such as brass and aluminum.

Salem-Brosius, Inc., P. O. Box 2222, Pittsburgh 30, Pa. **Circle 437**

Contour Saw

Infinitely variable speed drive from 50 to 600 fpm is tachometer-controlled

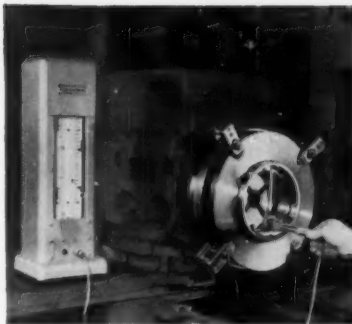


in this contour saw. The 24 x 28-inch table is adjustable 10 deg left and 45 deg right. Model 2600 accommodates blades with a maximum length of 187½ inches and minimum length of 180 inches. Hardened blade guides are replaceable and can be adjusted for blades from ⅛ to ½-inch wide. Chips are removed from the work area by airstream.

Peerless Machine Co., 160 Junction Ave., Racine, Wis. **Circle 438**

Gaging Instrument

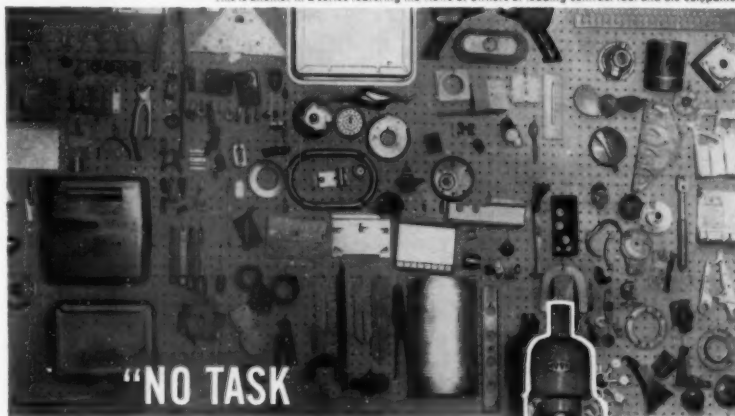
Speed of operation and improvement of grinding accuracy to fine tolerances can be achieved with this gage. The instrument combines low amplification long gaging range with high amplification close tolerance inspection in auto-



matic sequence. When a measurement is made, the right-hand column shows part size within the 18 thousandths range and the left-hand column spreads the final 2 thousandths over 4 inches.

The Sheffield Corp., Dayton 1, Ohio. **Circle 439**

This is another in a series featuring the views of owners of leading contract tool and die companies



"NO TASK seems too difficult for this remarkable new Moore No.3 Jig Borer"

...writes A. A. Zeise
of Tool Products Company, Minneapolis, Minnesota

"Our ability to offer the finest work on the best equipment has consistently rewarded us with gratifying success and steady growth during the past 13 years. With Moore equipment we have always been able to assure highest accuracy and top quality in our day-to-day toolroom work."

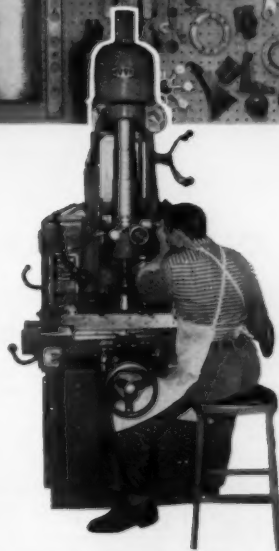
"And now, with the recent addition of our Moore No. 3 Jig Borer, we are hitting a new high in precision—constantly achieving tolerances of .000050 (50 millionths). Located in our temperature controlled room, no task seems too difficult for this remarkable Moore machine."

You, too, will easily break the "tenth" barrier—boring, drilling, reaming and spotting holes in dies, jigs, and production parts—with the new Moore No. 3 Jig Borer.

It offers more precise positioning tolerances...all hardened, ground and lapped ways...no gibs...no overhang...improved drive...and a speed range of 60 to 2250 RPM.

Write for illustrated brochure. Ask also for information on the new No. 3 Jig Grinder, which locates and grinds holes to less than a "tenth."

MOORE SPECIAL TOOL COMPANY, INC.
782 Union Avenue, Bridgeport 7, Connecticut



HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts the modern way. 424 pages, 495 illustrations. \$5 in U. S. A., \$6 elsewhere.

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TOOLS of today

Universal Bore Gage

Bore, O-ring grooves, thread reliefs and undercuts can all be measured by



indicators attached to this holder. Capacity of the gage is from 0.200 to 6 inches.

Montgomery & Co., Inc., 401 Morris Ave., Springfield, N. J. **Circle 440**

NOW...

SMALLER

CENTER DRILLS

Sizes "0" and "00"



**IN STOCK
ONLY AT W&S**

- Special-tool quality at stock-tool prices
- Drills and countersinks (60°)
- Finest high-speed steel
- Thousands job-tested
- Immediate availability

SPECIFICATIONS:

Size	Body Dia.	Drill Dia.	Drill Length	O.A.L.
#0	1/8"	1/32"	1/16"	1 1/4"
#00	5/64"	.025"	3/64"	7/8"

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Specialized Experience

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220

Nylon-to-Metal Weld

Bonding of nylon gears to metal shafts or the securing of threaded screws or rods in nylon and metal assemblies can be accomplished with an epoxy paste that chemically unites with the metal surface to which it is applied. A separate solvent solution applied to the nylon part softens the surface and allows the nylon molecules to blend with the epoxy bonding agent as the latter hardens. The two materials, PA-749 and PA-708, are supplied in separate containers, and the operation is performed at room temperature.

Plastic Associates, 2900 S. Coast Blvd., Laguna Beach, Calif. **Circle 441**

Impact Wrench

Rapid tightening of threaded fasteners to high torque can be accomplished with maximum operator comfort with this 4 1/4-lb. air-powered, reversible impact wrench. The 34 J, a 3/8-inch model, has an impacting mechanism that



provides three impacts per revolution and evenly distributes force over three surfaces. A step throttle provides control for thread engagement. Motor noise is minimized by a built-in muffler and adjustable exhaust deflector. The 8-inch long unit has a 1/2-inch square drive and 2500 rpm free run-down speed.

Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio. **Circle 442**

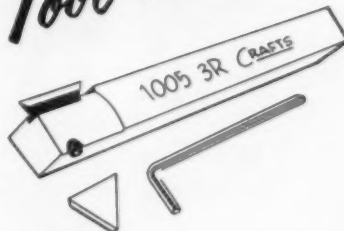
USE READER SERVICE CARD ON PAGE 239 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Solid-Head Boring Tools

Designed for use in engine lathes, turret lathes, jig borers, automatics, boring heads and boring machines, a line of solid-head high-speed steel and carbide-tipped boring tools are available in both standard and stubby models. The tools have round shanks with ground parallel flats to provide three-point clamping. The four flats facilitate



NEW MECHANICAL Tool Holder

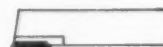


3/8" SQUARE-15° SHEAR

Crafts new #1005-9 Mechanical Tool Holders are ideal for Copper, Aluminum, Magnesium and Plastics.

These heat-treated shanks are made to accommodate inexpensive triangular Carbide Inserts — instantly indexable and easily replaced with hex wrench, furnished. Now stocked in 5 styles, Right and Left Hand.

#1005-3 R (R.H. Shown)
#1005-3 L (L.H.)



#1008-3 R (R.H. Shown)
#1008-3 L (L.H.)



#1009-3 R (R.H. Shown)
#1009-3 L (L.H.)



#1006-3 R (R.H. Shown)
#1006-3 L (L.H.)



#1007-3 R (R.H. Shown)
#1007-3 L (L.H.)



For More information write to:

ARTHUR A. CRAFTS CO., INC.

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The Tool and Manufacturing Engineer



sharpening by eliminating the need for special holding fixtures. Five shank sizes range from $\frac{3}{8}$ to 1 inch. Tools may be purchased in sets or individually.

Lido Tools, 843 W. 16th St., Costa Mesa, Calif. **Circle 443**

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Gun Drill Attachment

High-speed gun drilling on No. 5 or larger ram type turret lathes can be done without an adapter with this Mod-

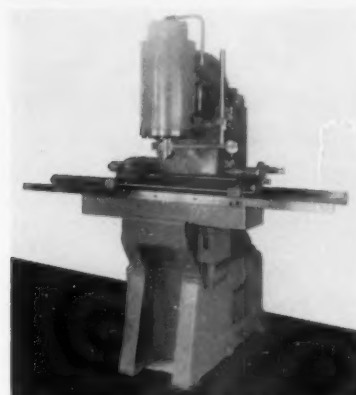


el 5-100 driller. With an adapter, it can be used with saddle type lathes. The $\frac{3}{4}$ -inch spindle bore accommodates drills from $\frac{3}{16}$ to $\frac{5}{8}$ inch. Twist drills, with or without oil holes, can also be used if their shanks are adapted to the bore. Spindle speeds are 1748, 2450, 3345 and 4600 rpm. Speeds to 6000 rpm are available in a high-speed model. Mounted on the turret face, the driller provides accuracy and rigidity even in indexing operations. Turret rotation is provided by a quick-disconnect coupling on the drill coolant line.

Ward-Riddle Co., Ravenna, Ohio. **Circle 444**

Hydraulic Press

Equipped with a straightening table and variable ram pressure control com-



bined with electrically operated ram control, this Model H-15-D hydraulic press has a 15-ton capacity.

Greenerd Arbor Press Co., Nashua, N. H. **Circle 445**

Carbide Inserts

Triangular carbide inserts with inscribed circles of $\frac{3}{32}$, $\frac{1}{4}$ and $\frac{3}{8}$ inch are available in screw-on or clamp-on styles. Minimum bore diameter of the screw-on type is 1.50 inches and that of the clamp-on type is 4.01 inches. Twenty-one unit sizes are available in zero, positive or negative rake angles. All units are adjustable in increments of 0.0005 inch on bore diameter per graduation on mounting dial.

Beaver Tool & Engineering Corp., 500 W. County Rd., Gaylord, Mich. **Circle 446**

WISCONSIN

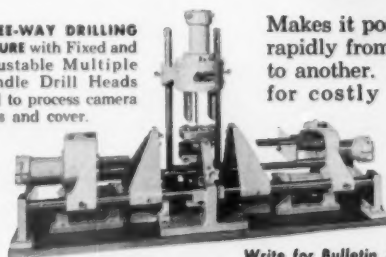
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**DRILLING,
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and BORING
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**THREE-WAY DRILLING
FIXTURE** with Fixed and Adjustable Multiple Spindle Drill Heads used to process camera cases and cover.



Makes it possible to change over rapidly from processing one part to another. Eliminates the need for costly special machines.

Makes it readily adaptable to a wide variety of production jobs.

Write for Bulletin 560 or visit Booth No. 621 at ASTME Tool Show, Detroit, April 21-28.



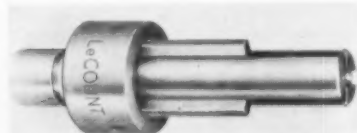
WISCONSIN DRILL HEAD CO.

4985 NORTH 124TH STREET • BUTLER, WISCONSIN
Use Reader Service Card, **CIRCLE 104**

TOOLS of today

Compact Mandrels

Short and light, but with wide expansion, a line of mandrels includes type C, 0.0005-inch TIR; type SC, 0.0002-



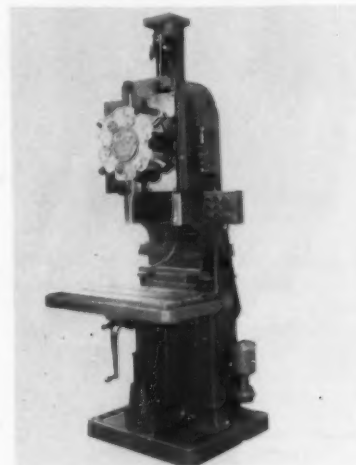
inch TIR; and type CMC, 0.0001-inch TIR. Ranging from $\frac{3}{8}$ to $3\frac{1}{4}$ inch, the 14 mandrels in the line have jaw bearings of from 1 to $2\frac{1}{2}$ inches.

LeCount Tool Works, Inc., 38 Cody St., West Hartford 10, Conn. **Circle 447**

Turret Drilling Machine

Many different operations can be performed at one work position with this hydraulic, power-indexed turret, six-spindle drilling machine. Drilling

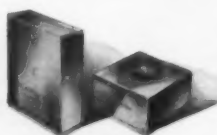
capacity in mild steel is $1\frac{1}{4}$ inch. All spindles have automatic depth control, with a micrometer adjustment on the depth stops, and may be skip indexed. Infinitely variable feed rate is from 0 to 120 ipm. Speeds, feeds, rapid advance and tapping cycles can be pre-selected. Spindle speeds available are



6 or 12. Pushbutton indexing of the turret and turret clamping are automatic. Turret spindle travel is 8 inches; rapid traverse rate is 240 ipm; and clearance from spindle to the 35 x 20-inch table is 8 to 35 inches. The machine is available with numerical control and a two-axis positioning table indexed by eight-hole tape. A computer is not required for tape programming.

Avey Div., Mott & Merryweather Machinery Co., Box 1264, Cincinnati 1, Ohio. **Circle 448**

Accuracy, Stability, Wear Life



These are qualities to look for in gage blocks—qualities you'll find finest by far in Ellstrom Chromium Plated Standards. Size, flatness, parallelism unconditionally guaranteed to closer specified millionths than any other blocks you can buy. Made only of time-tested materials fully certified for uniform hardness, absolute metallurgical stability. And gaging surfaces chromium plated by an exclusive Ellstrom process to give you longer wearing millionths, lower gaging costs. Next time you buy gage blocks, be sure you get the very best—be sure to specify

ELLSTROM CHROMIUM PLATED GAGE BLOCKS

MANUFACTURED AND CALIBRATED TO THE INTERNATIONAL INCH—EXACTLY EQUAL TO 25.4 MILLIMETERS

"W" Working Accuracy: $\pm .000008$ " / $-.000000$ "
Parallelism: $.000004$ " / Flatness: $.000004$ "

"I" Inspection Accuracy: $\pm .000004$ " / $-.000000$ "
Parallelism: $.000003$ " / Flatness: $.000003$ "

"L" Laboratory Accuracy: $\pm .000002$ " / $-.000000$ "
Parallelism: $.000001$ " / Flatness: $.000001$ "

Above: Ellstrom Rectangular Set No. 85-R. Left: Ellstrom Square Set No. 81-SA, with accessories. New Catalog contains prices and specifications—send for it today!

ELLSTROM STANDARDS DIVISION
DEARBORN GAGE COMPANY
22038 Beech Street • Dearborn, Michigan

Originators of Chromium Plated Gage Blocks

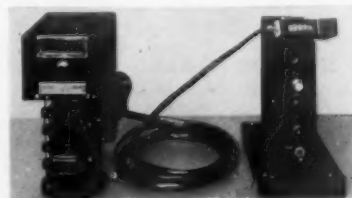


**Ellstrom—Measuring in millionths for three generations*

Hjalmar Ellstrom (1863-1942)—He gave mankind the key to mass production of interchangeable parts. For it was he alone who conceived and produced the world's first combination gage blocks—the first master reference standards accurate to the infinitesimal millionth part of an inch!

Electronic Micrometer

Automatic measurements to 10 millionths of an inch can be taken from a remote position with this instrument. The micrometer head, which operates on the screw thread principle, exerts



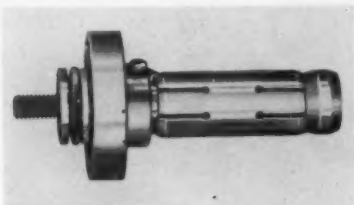
negligible pressure on the work. Measuring range is one inch. Digital readout to 10 millionths is shown on a counter on the operator's console. The head can be remotely zeroed in at any point within its measuring range. Heads may be used singly or in multiple.

J. W. Dice Co., Englewood, N. J. **Circle 477**

Use Reader Service Card, **CIRCLE 105**

Expanding Arbors

Available in various sizes and lengths, a line of expanding arbors have split type sleeves with either in-line or staggered grooves filled with a plastic substance that expands or contracts as the



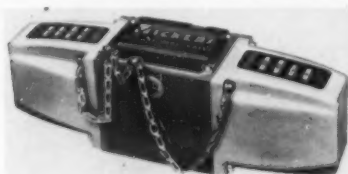
arbor is used. The plastic remains intact for as long as the arbor is used, keeping splines, shafts and gears free of chips, grinding dust and dirt. The split ends expand independently of each other, up to 0.006 inch.

LaSalle Machine Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich. **Circle 449**

USE READER SERVICE CARD ON PAGE 239 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Four-Way Control Valve

Solenoid operated, this four-way directional control valve has a nominal rating of 8 gpm and can handle flows up to 12 gpm without malfunction. Subplates are furnished with $\frac{3}{8}$ -inch ports



or $\frac{1}{2}$ -inch ports for larger flows. Maximum recommended operating pressure is 3000 psi. The solenoids are rated for 115 volts, 50 or 60 cycle a-c service. The valve is also available with oil-immersed solenoids.

Vickers Inc., Detroit 32, Mich. **Circle 450**

Preservative Paint

Ordinary lacquer formerly used as an insulator in the electrolytic grinding process has been replaced by a preservative paint that provides a metallic finish for the company's complete line of single-point carbide tools. Unlike lacquer, the paint does not have to be removed. It helps to conduct the current and improves the grinding process, making performance superior to that of unpainted tools.

Super Tool Co., 21650 Hoover, Detroit 13, Mich. **Circle 451**



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Master
Power
AIR
HOIST
ON
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TRIAL**
with absolutely
no obligation

Designed for 128 basic variations. A 10-day tool test will prove you cannot burn out or damage this hoist with an overload. Positive control from creep to full speed with safe lowering if air or brake fail. Explosion-proof model available. Mail coupon today to arrange a 10-day tool test.

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VK presents a COMPLETE LINE of **THREAD GAGES**

including Thread Plugs, Thread Rings and Truncated Setting Plugs.

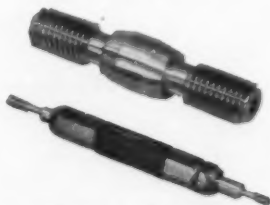
Conforming to H28 Screw Thread Standards, these gages are made under the most modern manufacturing and inspection facilities... eliminating all questions about size, lead, drunkenness, and angle.

Exceptional surface finish and geometry; — pitch diameters checked with VK Calibrated Thread Measuring Wires... all combine to give unparalleled quality. *Long gage life is assured.*

Send for new catalog 36B

VK originated the reversible plain plug gage. Here's another first, a new design in Reversible Thread Gages with these superior features:

- Lapped center holes, both ends
- Fit standard AGD handles
- No bushing necessary
- Center holes permit accurate lead check
- Priced the same as ordinary Reversible Thread Gages.



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174 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
... rated the world's most accurate

Plug Gages • Measuring Wires • Optical Flats and Light Wave Equipment • Gage Blocks
Precision Lapping Service and Parts

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TOOLS of today

Spot Welder

Air operated and water cooled, this No. 407 spot welding gun has a capacity of 14,000 amps. It has a 10-inch

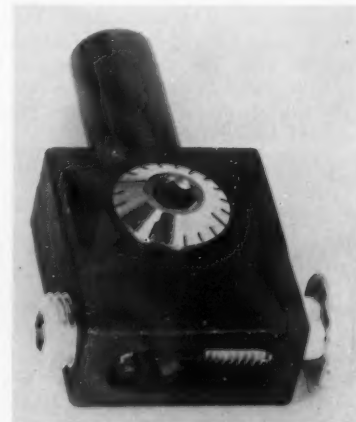


throat, with extension arms available up to 30 inches.

Aro Spot Welder Div., Guthery Machine Tool Corp., 38-31 Crescent St., Long Island City, L. I. **Circle 452**

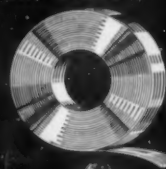
Toolholder

Designed for use on the manufacturer's second operation and chucking machines, this toolholder can also be used for holding boring tools on jig



borers, screw machines and milling machines. A taper screw acts as a wedge and flexes the body of the holder in relation to the shank, gives a clamping action that holds any setting, and can be turned in either direction to move

... from start



... to finish

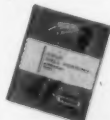
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Profits are available to you through the production of many shapes in metal... made with precision and economy on Yoder Cold Roll Forming Equipment.

Produce tubular, ornamental or structural shapes from a variety of metals in widths from a fraction of an inch up to 80 inches or more, and in stock up to 3/4" thick. Your investment is comparatively modest, and with proven low operating costs, will give you one of the most profitable operations in your plant.

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THE YODER COMPANY
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September 1960

the tool without backlash. Each of the dial's 20 divisions indicates 50 thousandths of an inch. The holder accommodates tools with round shanks of from 1/8 to 3/8 inch. Boring capacity is 1 1/4-inch diam.

Hardinge Bros., Inc., Elmira, N. Y.
Circle 453

Multiple Drill Head

Speeds high enough for very small drills on center distances as small as 3/8 inch can be provided with this multiple drill head. Designed for production of miniaturized parts, the head has speed ranges of 0 through 8000 rpm. All spindles are ball bearing



mounted, gears are case hardened, and hole center tolerances are ± 0.001 inch. Maximum distance between centers is three inches. Maximum drill size is No. 20. Case sizes available are two, three or four inches diam. Each drill head is designed and built to meet construction requirements.

Metron Instrument Co., 432 Lincoln, Denver 3, Colo. Circle 454

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Ultrasonic Cleaning System

Available in both high and medium intensity models, the Sonogen Z cleaning system has a lead zirconate titanate sandwich type transducer that operates at 25 kc. Tank capacities range from 2 to 75 gal, consuming 150 to 2000 watts. Operating as a full-wave system, it doubles the effective power output per unit area, permits higher cleaning speeds and provides higher cleaning efficiency.

Branson Ultrasonic Corp., 40 Brown House Rd., Stamford, Conn. Circle 455

When buying cutting tools insist on...

CROBALT

CAST ALLOY
CUTTING TOOL SPECIALISTS

UP TO 35% MORE PIECES PER GRIND... than other cast alloy tools

DOUBLE CUTTING SPEED... over high speed steel tools

CROBALT TOOLS WITHSTAND CHATTER, INTERRUPTED CUTS and HARD SPOTS... where carbide tools chip and break

HIGH EFFICIENCY ON PRACTICALLY ALL TYPES OF MACHINING

NO SPECIAL TOOL GRINDING EQUIPMENT OR PROCEDURES NECESSARY

EXCELLENT BRAZING CHARACTERISTICS

LOW COST

CONSISTENT HIGH QUALITY

ALL INDUSTRIES
CHOOSE CROBALT

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Gentlemen, please send your complete catalog information on your line of standard and custom Crobalt cutting tools.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____

State _____

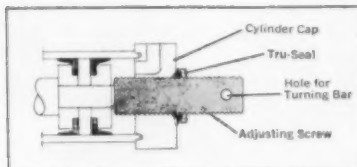
☐ We have a special cutting tool requirement. Attached are specifications for a prompt proposal and quote. We understand that we are in no way obligated.

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TOOLS of today

Adjustable Stroke Cylinders

A threaded adjusting screw that can be quickly sealed and unsealed with a threaded fitting provides fast adjustment of cylinder strokes. Installed in the cap end of the power cylinder, clockwise turning of the screw causes it to enter the cylinder bore where it acts as a stop to limit the stroke to the desired length. A straight-thread fitting seals the adjusting screw against air or oil leakage from the cylinder and keeps it locked in position. Light to medium wrench torque will retighten the fitting when the adjusting screw has been positioned. The cap end stroke



adjustment is available in all bore sizes of the manufacturer's air and hydraulic cylinders.

Miller Fluid Power Div., Flick-Reedy Corp., York and Thorndale Rds., Bensenville, Ill. **Circle 456**

Optical Aids Kit

Of particular value for quality control and inspection work, this compact kit contains more than 20 optical units that can be assembled into a variety

of optical viewers, surface comparators and microscopes. Magnifications vary from 7x, with the small optical viewer, to combinations of 10x, 20x, 40x and 80x with the various microscopes. A selection of reticles and measuring



scales ranging from divisions of 0.001 inch to 0.005 inch is included. The instruments are suitable for machine mounting as well as for bench inspection.

Bausch & Lomb Inc., Rochester 2, N. Y. **Circle 457**

Oil Film Bearings

Design advantages of sleeve and ball bearings are combined in a line of bearings that have a base life of 20,000 hours, a lifetime recirculatory oiling system, and a hydrodynamic oil film between inner race and bushing that supports the weight of the shaft. With



no metal-to-metal contact at any point, the bearings are vibration and noise-free, are resistant to humid and gritty atmospheres and do not leak oil. Operating temperatures range from -25 to 200°F. Bore sizes are from 8 to 40 mm.

Tann Bearing Co., Div. Tann Corp., 3750 E. Outer Dr., Detroit 34, Mich. **Circle 458**

31,000,000 ft
and still
going...



with **Ferro-Tic** *

At AVON Tube Ferro-Tic form rolls produced well over 31,000,000 ft of welded steel tubing on a job where tool steel formrolls ran only 1,000,000 ft

FERRO-TIC (the only machinable carbide in existence) combines the fabricating advantages of steel with the wear-resistance of carbide. In the annealed, completely dense state, **FERRO-TIC** can be machined with high-speed tools on conventional tool room equipment; thus, the need for costly diamond grinding is eliminated. Once hardened, by oil quenching from 1750°F, **FERRO-TIC** is extremely hard and wear-resistant. **FERRO-TIC** stock blanks can be fabricated into long-wearing components, using available tools and skills without delay! **FERRO-TIC** is ideal for: Blanking, Lamination, Deep Drawing and Heading Dies, Arbors, Core Rods, Wear Parts, etc. **FERRO-TIC** can be turned, drilled, milled, sawed, tapped. . . .



AGENTS THROUGHOUT THE U.S.A.
WRITE FOR ILLUSTRATED BULLETIN T-9

Division of **CHROMALLOY CORPORATION**

134 Woodworth Avenue • Yonkers 2, N. Y. YOnkers 9-6767

CHROMALLOY DIVISION, WEST NYACK, NEW YORK
CHROMIZING CORPORATION, LOS ANGELES, CALIFORNIA
PROPELLEX CHEMICAL DIVISION, EDWARDSVILLE, ILLINOIS
ELYRIA FOUNDRY DIVISION, ELYRIA, OHIO

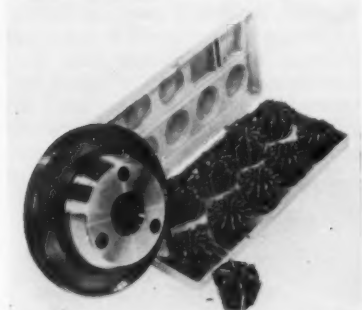
Use Reader Service Card, **CIRCLE 110**

*Reg. U. S. Trade Mark

**AVON Tube Div.
HIGBIE Mfg. Co.

Lathe Collet Chuck

Illustrated with a set of "Rubber-Flex" collets which it utilizes, the Model 50 chuck is designed to replace chucks using split steel collets. It has a nose type closure and a one-piece, high-impact handwheel made of phenolic with a steel insert. The chuck provides fast collet changing, capacity increases up to 42 percent, runout of no



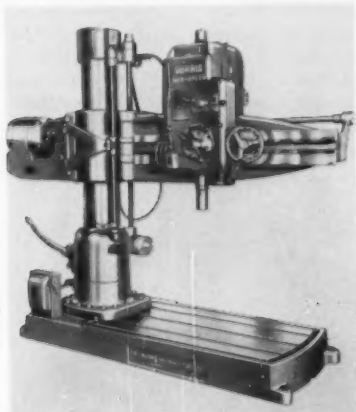
more than 0.001 inch at the nose, a range of 0.100 inch, and bar capacity of from 0.100 to 1.063 inches. It provides enough gripping power for heavy-duty cutting on light lathes. The spindle can be directly mounted without a threading adapter.

The Jacobs Mfg. Co., West Hartford, Conn. **Circle 459**

USE READER SERVICE CARD ON PAGE 239 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Radial Drill

Redesigned externally to increase durability and operator accuracy, this radial drill is available in 9-inch column heavy duty size with 3 and 4-inch arms;

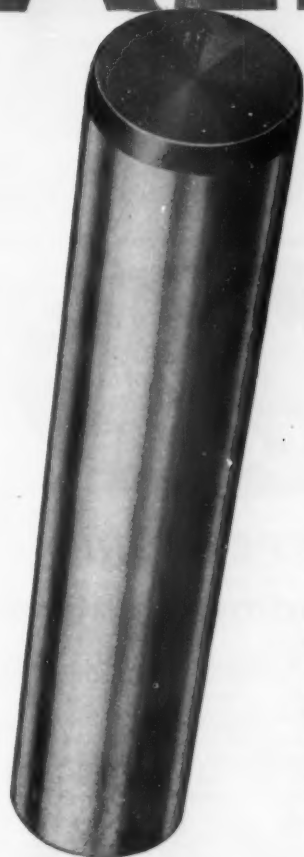


in 11-inch column heavy duty size with 3, 4, 5, and 6-inch arms; and in 9-inch light duty column size with 3 and 4-inch arms.

Morris Machine Tool Co., 2015 East-ern Ave., Cincinnati 2, Ohio. **Circle 460**

September 1960

ALLEN



**ALLEN is
the dowel pin
that gives
you PLUSES !**

Your ALLEN Industrial Distributor can show you a good many ways to use ALLEN Dowel Pins, in addition to conventional uses in tool and die work. You can use them as economical roller bearings, axles, precision plugs, hinge and wrist pins—and in many other ways.

You can cut the cost of your product substantially, too—because your ALLEN Distributor can supply these strong, accurate, mirror-finished Dowel Pins in standard sizes right from stock.

Made of special Allenloy steel; surface hardened to 62-64 Rockwell C; precision ground to .0001" with micro-inch finish of 6 RMS max. Check your Allen Handbook or Catalog for detailed specs and standard sizes, or write direct for samples and technical information.



Genuine ALLEN products are available only through your ALLEN Distributor—he's always ready, willing and able to give you prompt, practical service.



ALLEN MANUFACTURING COMPANY

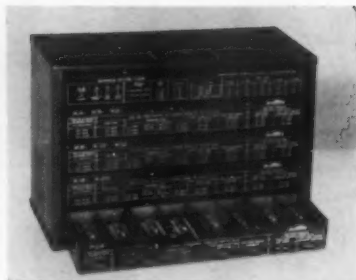
HARTFORD 1, CONNECTICUT, U.S.A.

Use Reader Service Card, CIRCLE 111

TOOLS of today

Stone Selection Kit

Designed to facilitate rapid selection of suitable stones for bore sizing and finishing requirements in the $\frac{1}{8}$ to $2\frac{5}{8}$ -inch diam range, the LN-610 kit meets needs encountered in ordinary general machine shop and toolroom work. Plastic drawers in the steel cabinet hold an assortment of 224 stones in 72 varieties of abrasives and stone sizes for use in deburring, stock removal and



finishing operations. Selection guides on the drawer fronts identify contents.



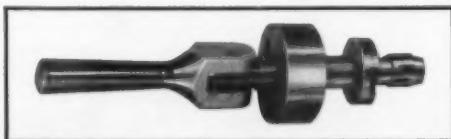
**LOCATION
TOLERANCES
OF .0004"**

with **SPEEDGRIP**
expanding locators

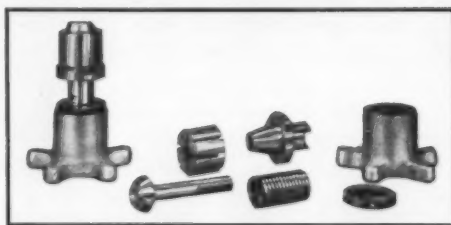
Gain accuracy—Save time—Avoid errors in loading or unloading work from fixtures! Speedgrip expanding locators are guaranteed to repeat fixture loca-

tion within .0004". Nationally known customers find Speedgrip locators indispensable for holding required tolerances! Assures easier loading and unloading of work.

No. 0 Speedgrip Locator with cam lever actuation. With corresponding bushings, this locator will accommodate bores from $\frac{1}{2}$ " to $\frac{3}{4}$ " dia.



No. 2 Locator with hand knob actuation. With expansible bushings, this locator can be used for bores from 1" to 2" dia.



This No. 5 locator can be supplied for either wrench or draw bar actuation. Has precision ground pilot on under side of flange for mounting to fixture. With expansible bushings, this locator can accommodate bores ranging in size from 5" to 11" dia. Locators, with various means of actuation can accommodate bores, ranging from $\frac{3}{8}$ " to 11".

Some Open Territory • Dealer Inquiries Invited

FREE!

Write for Bulletin No. 27 for full description and technical details.

SPEEDGRIP CHUCK

Division of ERNEST, HOLDEMAN & COLLET, INC.
Elkhart, Indiana

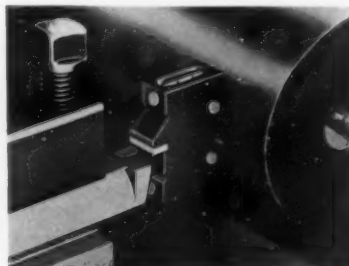
Use Reader Service Card, CIRCLE 112

All stones are code numbered for positive identification. The top drawer, for utility use and storage of accessories, has a table of attainable finishes printed on the front.

Sunnen Products Co., 7910 Manchester Ave., St. Louis 17, Mo. **Circle 461**

Cutting Tool Gage

Lathe type cutting tools can be set to a known amount above or below or the exact work centerline with this magnetic gage, accurate to within ten thousandths of an inch. An anvil in the forward edge of the gage assures exact machining at the desired point.

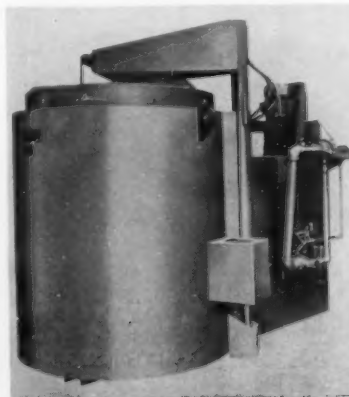


A chart furnished with the tool translates spirit level graduations into thousandths of an inch, either above or below the centerline as desired. The gage can also be used for right angle measurement and for leveling of equipment.

Tru-Center Products Co., P. O. Box 731, Decatur, Ill. **Circle 462**

Air Draw Furnace

Gas-fired or electrically heated, this convection furnace is designed to meet severe operating conditions and provide accuracy in lower range heat treating. Specific applications are in tempering, drying, annealing, solution treatment and aging operations. One temperature range provides a maximum of 1350 F;



a maximum of 1700 F. Parts can be suspended, fixtured or placed in baskets for heat treating. Top loading allows easy access with an overhead crane and makes it possible to place, suspend and rapidly remove long shafts or heavy parts.

Hevi-Duty Electric Co., Milwaukee 1, Wis. **Circle 463**

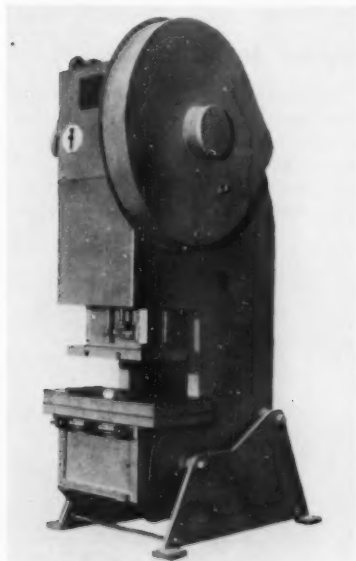
Prehoned Disposable Inserts

Mechanically prehoned inserts provide edges of uniform radius that vary only in accordance with service specifications. A medium radius is used for semifinishing and a heavier radius for roughing. Production tests indicate that prehoned inserts have about a 35 percent longer predictable tool life than unhoned inserts. Prehoning also allows use of harder and more durable grades.

Metallurgical Products Dept., General Electric Co., Detroit 32, Mich. **Circle 464**

OBI Press

Single-gear, this mechanical press has a fully guided, large diameter, long barrel type adjusting screw and pneumatically balanced slide. Formica-lined

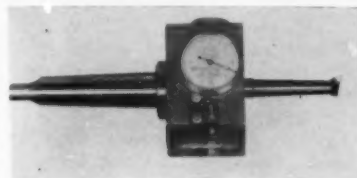


gibs and long gib ways maintain accurate alignment of the slide. Equipped with an air friction clutch and brake assembly, the press has a safety-locked electric pushbutton control. The clutch control has a four position selector switch.

Ferracute Machine Co., Bridgeton, N. J. **Circle 465**

Boring Head

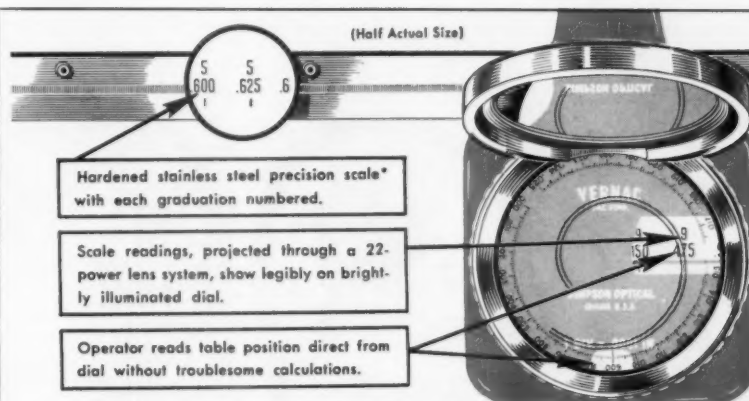
Equipped with two calibrated dials, this holder provides boring accuracy within 50 millionths of an inch. The head is equipped with a micrometer dial that gives direct readings as the



boring head is moved. The dial indicator reads the cutting tool movements and compensates for backlash, thread compression and other friction moving possibilities. The tool slide can be adjusted from zero to one quarter inch off center. Models for 3/8-inch and 1/2-inch tool shanks can be used in any vertical or horizontal boring and milling machine or any type lathe.

Bokum Tool Co., 14755 Wildemere, Detroit 21, Mich. **Circle 466**

USE READER SERVICE CARD ON PAGE 239 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION



New optical measuring instrument assures . . .

high operating accuracy for new or used machine tools

The new VERNAC Direct Reading Optical Measuring Instrument eliminates the complexities of using end rods and gage blocks. Now, the longitudinal, lateral or vertical positioning of machine tool tables can be quickly and easily read direct to .0002". Accuracy is not affected by the wear or stretch of table movement screws. The instrument itself has no moving parts which can impair accuracy.

VERNAC instruments also up-grade machine tools to perform tasks beyond their original accuracy. For example, they can up-grade moderately priced milling machines to the accuracy of more expensive jig boring machines at a fraction of the latter's cost.

*The scale is a replica of a master certified by the U.S. National Bureau of Standards to .0001" maximum error over its entire length.

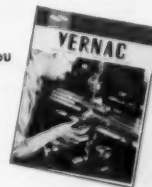
SEND FOR FREE BULLETIN. Explains how the VERNAC enables you to do more precise work on your present machine tools.

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SIMPSON OPTICAL MANUFACTURING CO.
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of precision optics for scientific
equipment since 1926.



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Simpson Optical Manufacturing Company, 3202-04 Carroll Ave., Chicago 24

Send me free literature describing the VERNAC Optical Measuring Instrument.

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Company

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City

Zone

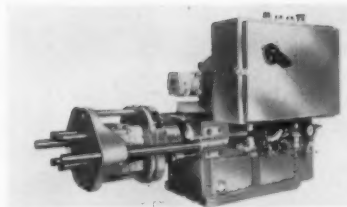
State

Use Reader Service Card, **CIRCLE 113**

TOOLS of today

Tapping Machine

Self-contained, this tapping unit can be mounted in any position. The machine uses one coarse pitch ground thread lead screw and nut for pitch change, producing accurate threads and providing economy of wear. Tapping pitch is changed by one gear at the back of the unit, rather than through change of the lead screw and nut. Maximum stroke is five inches, with a three-

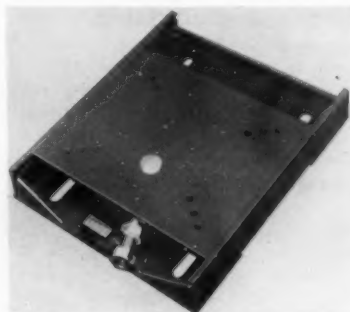


inch rapid approach and two-inch lead screw travel. All movements are adjustable and can be correlated for automatic operation.

Thriftmaster Products Corp., 1048 N. Plum St., Lancaster, Pa. **Circle 467**

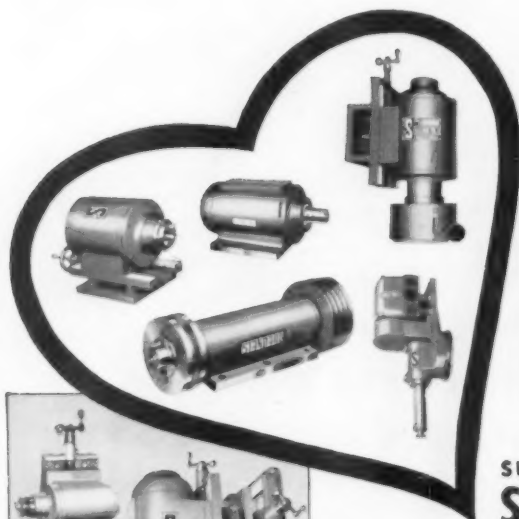
Pancake Motor Base

Low, sliding motor bases with a provision for rapid release of the adjusting screw are designed for use in variable-speed sheave installations where space is at a premium. The base can be quickly and easily moved to shorten center-to-center distance and free V-belts from the grooves for sheave adjustment. Height of the base is either



1 $\frac{1}{16}$ or 1 $\frac{1}{2}$ inches, depending on NEMA motor frame number. Amount of movement is either 4 $\frac{1}{2}$ or 6 inches. Bases with nine-inch movement are available on special order. Top plate of the base is drilled to accommodate various combinations of NEMA motor frames.

T. B. Wood's Sons Co., 485 Stephens Ave., SW., Atlanta, Ga. **Circle 468**



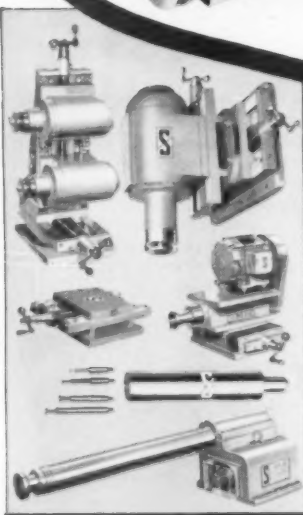
THE HEART OF THAT SPECIAL MACHINE

MACHINE TOOL OR CONVERSION

SUPER PRECISION SPINDLES, SLIDES, FEEDS AND TABLES by STANDARD

Use the "building block" technique on that machine design problem. A Standard Super Precision Spindle PLUS the proper STANDARD slide, feed or swivel is truly "the heart" of the special machine that will do your special job. Standard Super Precision Spindles will mill, drill, bore or grind and Standard slides, feeds and swivels will take the spindle to the work, or vice versa, ACCURATELY A THOUSAND TIMES A THOUSAND TIMES!

Send for Standard's complete new Spindle Catalog TODAY . . . working drawings, specifications, complete technical data, on "building block" installations working all over America right now!



the **STANDARD** SPINDLE DIVISION electrical tool co.
SUPER PRECISION SPINDLES AND MACHINE TOOLS
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BOOTH 1450
MACHINE TOOL
EXPOSITION
CHICAGO
SEPT. 6-16

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Holder for Chipbreaker

Fine adjustment of chipbreakers and close control of chips in machining operations are possible with this toolholder. Wide-range chip control is provided by screw adjustment to an infinite number of chipbreaker plate

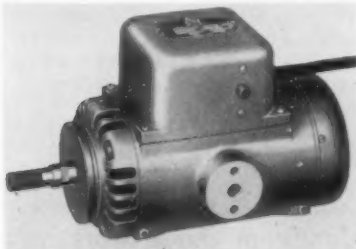


positions within the range. The adjusting nut is readily accessible on top of the toolholder regardless of tool position and the chipbreaker retains its position while indexing or changing inserts. The 70 styles and sizes of the toolholder accommodate standard square and triangular inserts.

Kennametal Inc., Latrobe, Pa. **Circle 469**

Power Tool Motor

Applicable for use with woodworking, masonry and metalworking power tools, this motor provides for 360-deg positioning. The shaft centerline-to-base dimension is 1 $\frac{3}{4}$ inches, permitting close

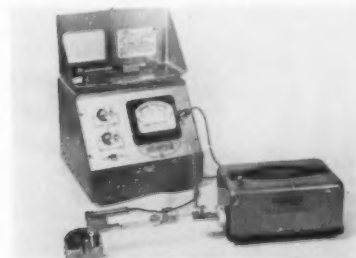


proximity to workpieces. Available with $\frac{3}{4}$, 1 and 1 $\frac{1}{2}$ -hp ratings, the motors provide 200-percent capacitor-start torque.

Franklin Electric Co., Inc., Bluffton, Ind. **Circle 470**

Measuring Instrument Adapter

Surface in the bottoms of holes as small as $\frac{3}{8}$ -inch ID can be measured to a maximum depth of 1 inch with this adapter for an instrument for measuring surface finish. Removal of the motor drive tong from the adapter permits measurement of bottoms of holes, slots, counterbores or other below-surface areas, with an ID of 3 inches to a

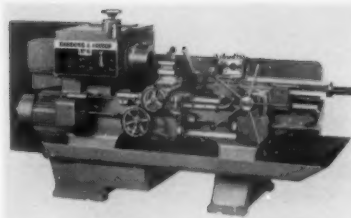


maximum depth of 2 inches. The BL-132 adapter can be used either for hand-held or motor-driven operation. Surface roughness measurement range is 0 to 250 microinches.

Brush Instruments Div., Clevite Corp., 37th and Perkins, Cleveland 14, Ohio. **Circle 471**

Ram Type Turret Lathe

Three-inch spindle capacity for heavy-duty bar work, five-inch capacity for light-duty bar work and 21 $\frac{1}{8}$ -inch swing over the bed ways is provided by this lathe. The headstock provides 16



geared spindle speeds, up to 30 constant horsepower, speed range of 50 to 1, spindle speed preselection and automatic spindle speed changes. Twelve speed changes are provided for the

cross slide, carriage and hexagon turret. All attachments and a complete line of tooling are available.

Bardons & Oliver, W. 9th & Oliver Aves., Cleveland, Ohio. **Circle 472**

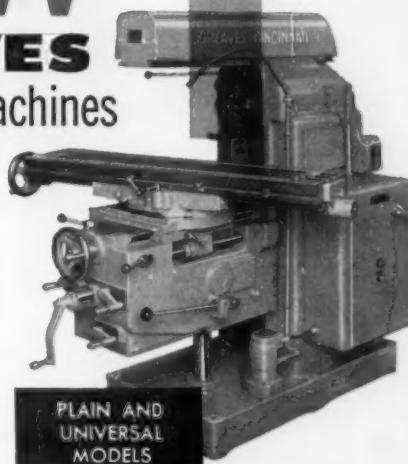
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Four-Way Valve

Solenoid operated, this three-position four-way air valve can "inch" an air-actuated device to any desired position and hold. It is available in either closed

new GREAVES 2-XH Milling Machines

more
power at
the cutter!



PLAIN AND
UNIVERSAL
MODELS

The completely new GREAVES No. 2-XH Milling Machine brings added versatility, increased operational ease, and more power where it's needed most . . . at the cutter!

It utilizes two motors, one for spindle drive; a separate motor for moving table, saddle and knee. Compare this and the other outstanding features of the new Greaves Mill. You'll see why Greaves is "The MOST Mill for the LEAST Money."

See them at Booth 1439
Donovan Hall, 1960
NMTBA Exposition

GREAVES

MACHINE TOOL DIVISION

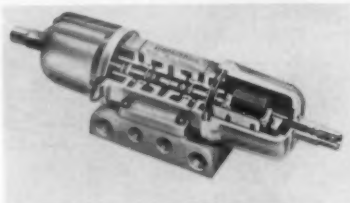
J. A. FAY & EGAN COMPANY

2303 Eastern Avenue, Cincinnati 2, Ohio

- Wide range of speed/feed combinations for any type material, any type job.
- Heavy, internally ribbed column casting and heavy duty rectangular overarm for maximum rigidity.
- Large, heavy-duty knee, saddle and table provide accuracy for all types of milling.
- New 7 $\frac{1}{2}$ HP spindle drive motor, with separate motor for movable components, provides extra power for heavy milling.
- Easy-to-reach controls. Handwheels and vertical crank disengage automatically when not in use.
- New rapid traverse lever within operating control area.
- Separate drive motor for table, saddle and knee provides more smooth balanced power at the cutter.

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TOOLS of today



or open-center design. Both $\frac{3}{8}$ -inch part size models, with built in manual operators, utilize a prewired body and

base with a plug-in feature that allows the valve body to be removed without disturbing any electrical wiring. Connection is automatically made when body is reassembled.

Mechanical Air Controls, Inc., 10030 Capital Ave., Detroit 37, Mich. **Circle 473**

Rotary Files

Design of a line of tungsten carbide rotary files increases efficiency, life-span and range of applications of the tools. Construction of the file teeth embodies



a second trailing edge built into the full length of each tooth, increasing the over-all strength of each flute and resulting in faster and smoother stock removal. Chip-loading and buildup of edges is reduced.

Grobet File Company of American, Inc., Carlstadt, N. J. **Circle 474**

MEASURE TO 0.0001" IN 3 DIMENSIONS WITH UNITRON'S TOOLMAKERS MEASURING AND METALLURGICAL MICROSCOPE



The UNITRON Model TM is more than just a measuring microscope. It is the only instrument which combines in one stand a completely equipped tool-makers microscope for precise measurements — LENGTH, WIDTH and DEPTH, and a metallurgical microscope for examining the structure of polished metal samples under high magnification.

NOTE THESE QUALITY OPTICAL & MECHANICAL FEATURES

- **Objectives:** achromatic, coated, 3X, M10X, M40X. **Eyepiece:** coated K10X with crosshair.
- **Magnifications:** 30X, 100X, 400X; up to 2000X with accessories.
- **Focusing:** Both dual control rack and pinion coarse and micrometer-screw type fine adjustments. Body has locking device.
- **Three Illuminators:** sub-stage, surface and vertical, have variable intensity.
- **Combination Stage:** rectangular ball bearing with linear measurements to 0.0001" and rotary measurements to 5" with vernier. (Metric model available on special order.)
- **Depth Indicator:** measures in units of 0.0001" by "optical contact" with specimen.
- **Projection Screen:** available as accessory for optical comparison.
- **Eyepiece Turret:** available as accessory for measuring surfaces, radii, thread pitch etc.

In fitted hardwood cabinet

\$1050
FOB Boston

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INSTRUMENT DIVISION OF UNITED SCIENTIFIC CO.
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THE TREND IS TO UNITRON

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Aluminum Oxide Abrasive

Developed especially for stainless steel billet and slab grinding, an abrasive for grinding wheel applications provides greatly increased metal removal per wheel, fast cutting rate, long wheel life and as much as 40 percent reduction of total cost per pound of metal removed.

Norton Co., Worcester 6, Mass. **Circle 475**

Drills for Hardened Steel

Generating intense heat, which is confined to a small area adjacent to the hole, a line of drills for hardened steel anneal the material at the drill point area as heavy pressure is applied. The drills themselves have high red-heat



hardness and are not affected by the intense heat except for a slight rounding-over of the point, which helps the heat generation. The drills can be successfully used on 51 Rc steels, manganese steels and similar work-hardening metals, but are not recommended for use on materials that are naturally hard and cannot be annealed.

The DoAll Co., Des Plaines, Ill. **Circle 476**

who's meeting and where

Sept. 6-16. NMTBA. Machine Tool Exposition. International Amphitheater, Chicago, Ill.

Sept. 6-16. PRODUCTION ENGINEERING SHOW. Navy Pier, Chicago, Ill. Information available from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

Sept. 7-9. ASME. Joint Automatic Control conference. M.I.T., Cambridge 39, Mass.

Sept. 7-15. SECOND COLISEUM MACHINERY SHOW. Coliseum, Chicago, Ill.

Sept. 11-14. MHI. Joint industry fall meetings. The Cavalier Club, Virginia Beach, Va.

Sept. 11-20. EUROPEAN MACHINE TOOL SHOW. Fairgrounds, Hanover, West Germany. Information available from the German American Chamber of Commerce, 666 Fifth Ave., New York 19, N. Y.

Sept. 14-15. Fourth annual military-industrial Electronic Test Equipment symposium. Museum of Science and Industry, Chicago 16, Ill. Information available from Robert Brausch, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

Sept. 15-16. ASME. Engineering Management conference. Morrison Hotel, Chicago, Ill.

Sept. 19-20. SFSA. Fall meeting. The Homestead, Hot Springs, Va.

Sept. 21-23. ASME-AIEE. Power conference. Bellevue-Stratford Hotel, Philadelphia, Pa.

Sept. 26-28. STANDARDS ENGINEERS SOCIETY. Ninth annual meeting. Hilton Hotel, Pittsburgh, Pa.

Sept. 26-29. AMERICAN WELDING SOCIETY. National fall meeting. Hotel Penn-Sheraton, Pittsburgh, Pa.

Sept. 26-30. INSTRUMENT SOCIETY OF AMERICA. Fall Instrument-Automation conference and exhibit and 15th annual meeting. Coliseum, New York, N. Y.

Sept. 27-28. NSMPA. Executive seminar. St. Clair Inn, St. Clair, Mich.

September 1960

Are you designing to series 60 standards? If so, specify Bristol.



This DOUBLE-DIAMOND knurl marks the BRISTOL "Series '60"

... the cap screw that holds more ... indents less ... wrenches tighter than ever before ... meets or exceeds all new "Series 1960" standards of Socket Screw Manufacturers' Committee. Of course, regular Bristol "Series 1936" standard screws are still available in hex or Bristol Multiple Spline.

Precision socket screw manufacturers since 1913



*Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap screws up to 1 1/2" diameter.

THE BRISTOL COMPANY Socket Screw Division
Waterbury 20, Conn.

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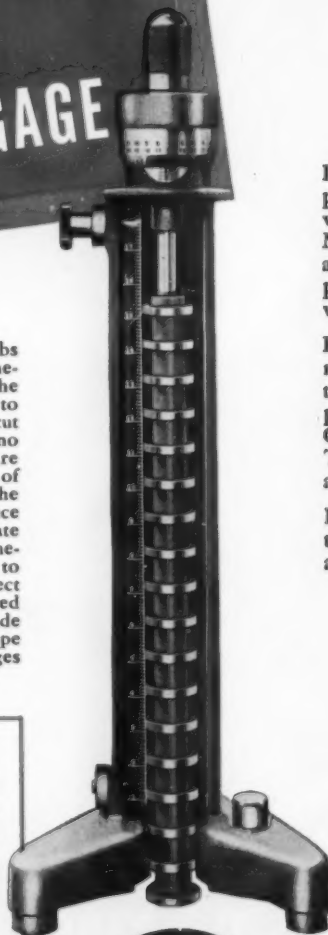
Products of Precision by CADILLAC GAGE

PLA-CHEK GAGES

In thousands of installations on innumerable jobs PLA-CHEK Gages are daily proving their time-saving and money-saving advantages, both at the surface plate and the machine. Extremely easy to operate—and fast, too,—PLA-CHEK Gages cut inspection time from minutes to seconds with no loss of accuracy. No auxiliary gage blocks are necessary. PLA-CHEK'S measuring bar is made of deep-frozen, strain-free alloy steel. Steps on the bar are exactly 1" apart. Because of its one-piece construction, steps cannot change or separate with age. Adjustment of the bar is by the micrometer thimble at top. Since it is not necessary to touch the measuring bar, body heat cannot affect it. All reference surfaces are ground and lapped to extremely close tolerances. Precision-made risers, which give PLA-CHEK even more scope and are engineered as accurately as the gages themselves, are available for all models.

COMPLETE RANGE OF SIZES

PLA-CHEK Gages are available in a full range of sizes to meet every inspection or surface plate layout requirement. Models are: The easily portable 6", 12" and 18" sizes, each guaranteed accurate throughout its entire range to .00005"; the 24" guaranteed to .0001" over its entire range; and the 36" and 48" sizes guaranteed accurate to .0001" in any 24" length or .0002" over their entire range.



If it's precision you want—guaranteed precision—you've come to the right place when you specify Cadillac Gages and Measuring Instruments. For Cadillac is a name built over the years on accuracy, precision, quality, long instrument life, value and economy.

From the famous PLA-CHEK Gages, now proved in hundreds of plants throughout industry, through the complete line of Thread Ring, Thread Plug, Cylindrical Ring, Cylindrical Plug, Pipe Thread and Concentricity Gages, neither accuracy nor quality is ever sacrificed.

If your operations require really close tolerances, specify Cadillac Gages . . . and get guaranteed accuracy.



CYLINDRICAL RING GAGES

Deep frozen for stability and long life, Cadillac Cylindrical Ring Gages reproduce assembly conditions exactly.



THREAD PLUG GAGES

Full length of gaging member is available for inspection. Worn or damaged end may be reversed in collet. Available in a full range of sizes.



THREAD RING GAGES

Manufactured of the finest alloy steel, these gages are heat and cold-treated for maximum stability. They are carefully lapped and closely inspected under controlled conditions.



CYLINDRICAL PLUG GAGES

Available in a full range of sizes, these cylindrical plug gages provide unconditionally guaranteed accuracy.

Cadillac

GAGE COMPANY

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Trade Literature

for free booklets and catalogs—use request card, page 239

STOPPING VIBRATION, shock and noise transmission through use of steel spring machinery mountings is discussed in bulletin K3C. The Krofund Co. **(Circle 401)** . . . Detailed information on cylindrical roller thrust bearings is presented in 28-page catalog PT-659. Rollway Bearing Co. **(Circle 402)** . . . A number of products for the toolroom are described in a 4-page bulletin. The Producto Machine Co. **(Circle 403)** . . . Catalog No. 60 is a detailed, 68-page presentation of the manufacturer's tools. Chicago-Latrobe. **Circle 404** . . . Expanding arbors are described in catalog sheet No. 120. LaSalle Machine Tool, Inc. **(Circle 405)** . . . Twelve-page technical bulletin B-46 covers the ballizing process for hole sizing and finishing. Industrial Techtonics, Inc. **(Circle 406)** . . . A cold metal forming machine is described and illustrated in bulletin C-155. Curvit Div., Macdodyne Corp. **(Circle 407)** . . . Complete specifications of a line of electrolytic supply units are presented in bulletin No. 125. Anocut Engineering Co. **(Circle 408)** . . . "A New Approach to Leveling" contains data on industrial alignment problems and solutions and product data on a leveling kit, component parts and accessories. Optics and Metrology Div., Keuffel & Esser Co. **(Circle 409)** . . . Case Study Portfolio No. 1 shows a variety of applications of steel bars in metalworking machinery and equipment parts. La Salle Steel Co. **(Circle 410)** . . . Gas-combustions and control equipment is presented in an eight-page catalog. Bryant Industrial Products Corp. **(Circle 411)**

Automation & Mechanization

Automation components and assembly machines are illustrated and their special purposes explained in 46-page catalog 60. Precision Detroit Co. **(Circle 412)** . . . Six-page bulletin 577 covers application information and design developments on photoelectric eyes. Photomation, Inc. **(Circle 413)** . . . A 22-page, pocket-size glossary, "Do You Talk 'Computerese'?", is designed to make computer language intelligible to the layman. Minneapolis-Honeywell Regulator Co. **(Circle 414)** . . . "Break-

ing the Cost Barrier with Electronic Automation" is an illustrated booklet emphasizing the wide range of cost reducing applications of electronics. Strand Engineering Corp. **(Circle 415)** . . . "Show Case of Numerical Control" presents point-to-point numerically controlled positioning equipment. Pratt & Whitney. **(Circle 416)** . . . An illustrated specifications catalog covers a line of air control valves. Hoffman-Odom Co. **(Circle 417)** . . . Bulletin 91024 describes and illustrates 2, 3 and 4-way electrically operated valves. Airmatic Valve Co. **(Circle 418)** . . . Thirty-two page bulletin 27B provides a variety of specific information on a proximity die saver switch. Robotron Corp. **(Circle 419)** . . . "Uses Unlimited," Vol. 12, No. 1, includes information on a number of switches and their applications. Micro Switch Div., Minneapolis-Honeywell Regulator Co. **(Circle 420)** . . . Metal chip handling systems are described in 12-page book 2926. Link Belt Co. **(Circle 421)** . . . Catalog 605 covers a line of vibratory materials handling equipment, vibrating parts handling equipment, other equipment and tools. Syntrol Co. **(Circle 422)**

Boring, Drilling & Tapping

"Harper Thread Guide" is a 16-page illustrated booklet offering a basic introduction to varied types of threads. H. M. Harper Co. **(Circle 423)** . . . Bulletin No. 110 covers the problems of precision hole depth control. Wohlrip Products, Inc. **(Circle 424)**

Casting & Molding

Form No. C-8 describes and illustrates the carbon dioxide foundry process for producing castings to critical tolerances. Cardox Div., Chemetron Corp. **(Circle 425)** . . . A casting technique is described and illustrated in a brochure titled, "The Shaw Process—Precision Ceramic Casting in the Foundry and Tool-making Industries." Shaw Process Development Corp. **(Circle 426)** . . . A castable form of ceramic fiber, FC-25, is described in Fiberfrax technical data sheet. Ceramic Fiber Project, Research & Development Div., The Carborundum Co. **(Circle 427)**

Electric Motors, Controls & Drives

Bulletin 605 provides detailed information about the type PE5 photoelectric scanner relay. Farmer Electric Products Co., Inc. **(Circle 428)** . . . Electro-mechanical control systems and components for use on a wide variety of production machinery are described in six-page bulletin EE-1008. Electronic Div., Seneca Falls Machine Co. **(Circle 429)** . . . Fourteen-page bulletin No. GEC-1049 is a selection, application and buying guide for single and three-phase induction motors from $\frac{3}{4}$ to 150 hp. General Electric Co. **(Circle 430)** . . . Technical data sheets No. 3120 and No. 3140 detail model 368 and model 488 permanent magnet printed d-c servo motors. Photocircuits Corp. **(Circle 431)** . . . Bulletin No. 101 describes the operation and performance of adjustable speed drives ranging in size from $\frac{3}{4}$ to 4 hp. The Louis Allis Co. **(Circle 432)** . . . Bulletin M220 details design features and performance advantages of R/M CX molded V-belts. Manhattan Rubber Div., Raybestos-Manhattan, Inc. **(Circle 433)** . . . Engineering catalog HGB illustrates and describes a line of enclosed worm gear drives and includes simplified selection procedures and rating tables. Foote Bros. Gear and Machine Corp. **(Circle 434)** . . . Two-page data sheet describes an electronic adjustment device to reduce wheel wear, achieve uniform finishes and avoid high compound costs. Packer Machine Co. **(Circle 435)** . . . Book 2824, "Worm Gear Speed Reducers," is a 66-page introduction of a new line of fan-cooled worm gear speed reducers in 25 types and more than 135 sizes. Link-Belt Co. **(Circle 436)**

Fastening & Joining

Brochure 2-1424 gives specifications on a method of obtaining load bearing threads for later bolt or screw fastening in thick or thin ductile sheet metal with the P37 P-nut. Hi-Shear Rivet Tool Co. **(Circle 437)** . . . Review of the relative economics of set screw installations by several methods is featured in four-page bulletin 2302. Standard Pressed Steel Co. **(Circle 438)** . . . Various types and

Trade Literature


applications of flash-butt welders are illustrated and described in bulletin No. 7-213A. Taylor Winfield Corp. (Circle 439) . . . "Brazing News No. 83" points up the freedom, flexibility, facility and function of the process. Hardy & Harman (Circle 440) . . . Form 300D describes a spray welding unit and outlines the process. Wall Colmonoy Corp. (Circle 441) . . . Bulletin No. 9-013 illustrates and describes transformer for resistance welders. Taylor Winfield

Corp. (Circle 442) . . . A 24-page manual describes brazing techniques on all commercial brazeable metals and alloys. All-State Welding Alloys Co., Inc. (Circle 443) . . . Automatic and semi-automatic arc welding equipment, applications and processes are covered in a six-page folder. Hobart Brothers Co. (Circle 444) . . . Available as a reprint from the quarterly, "Cobalt," a technical instruction article is titled, "The Welding and Brazing of Certain Cobalt-Containing Alloys." Cobalt Information Center, Battelle Memorial Institute. (Circle 445) . . . Electron beam weld-

ing is described and illustrated in a 12-page catalog, form ADC 937. Air Reduction Sales Co., Div. of Air Reduction Co. (Circle 446) . . . Twenty-three NCG welding filler rods for use in welding nine different metals are listed with competitive brands in a comparison chart. National Cylinder Gas Div., Chemetron Corp. (Circle 447) . . . Features, applications and specifications for constant voltage power suppliers for precision welding are described in a four-page brochure. Glenn Pacific Power Supply Corp. (Circle 448) . . . Copper-clad electrodes for use with the manufacturer's metal removal process are described in a six-page folder. Arcair Corp. (Circle 449) . . . An index mechanism for dial feed welders is described in 12-page illustrated bulletin 8-213. Taylor Winfield Corp. (Circle 450) . . . The Resistance Welding Alloy Association's system for specifying spotwelding tip size is used in 24-page catalog 1308. Air Reduction Sales Co. (Circle 451) . . . A pocket size card, "Eight Factors to Consider in Selecting Arc Welding Electrodes," gives application information on all mild steel electrodes with AWS-ASFTM identification and classification. Hobart Brothers (Circle 452) . . . Eighty pages of arc welding information are provided in "Vest Pocket Guide to Better Welds." Hobart Brothers (Circle 453) . . . A line of welding equipment is covered in 16-page catalog F-1393. Linde Co. (Circle 454) . . . Catalog F1379 describes a line of welding machines, torches and supplies (Circle 455) and illustrated case histories of time and cost savings achieved are presented in a second booklet, F-1376. Linde Co. (Circle 456) . . . Latest issue of "Elastomer News for Automotive Engineers" highlights an article on spot welding of hand panels with neoprene adhesive. E. I. de Pont de Nemours & Co., Inc. (Circle 457) . . . A line of electrical and electronic paste solder materials is described in the E-Series bulletin. Fusion Engineering. (Circle 458) . . . Details of an automatic printed circuit board soldering system are covered in catalog A. 1090. Industrial and Automation Div., Radio Corporation of America. (Circle 459) . . . Catalog No. N.S. 60 covers a line of portable air tools for screwdriving and nutsetting. Master Power Corp. (Circle 460)

Finishing & Grinding

A line of portable, air powered metal finishing tools is described and illustrated in catalog G-60. Master Power Corp. (Circle 461) . . . Features of the model 612 surface grinder are described in a four-page illustrated brochure. Harig Mfg. Co. (Circle 462) . . . Specifications on media and compounds for



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barrel and vibratory finishing are contained in bulletin No. 901. Lord Chemical Co. (Circle 463) . . . Tangential angle wheel dressers and parts are covered in a new catalog. L. Newman. (Circle 464) . . . A fixture for grinding irregularly shaped perforators is described in the "Grind-All" brochure. Harig Mfg. (Circle 465) . . . Bulletin LS-60 covers barrel tumbling equipment. Tumb-L-Matic, Inc. (Circle 466) . . . Horizontal and vertical disk grinders are covered in an eight-page catalog. Besly-Welles Corp. (Circle 467) . . . Bulletin 401 illustrates and describes a bench type end finishing machine. Pines Engineering Co., Inc. (Circle 468) . . . The current issue of "Diamond Data," Vol. 1, No. 4, presents an article documenting the qualities of diamonds other than superiority of hardness that makes diamond grit an effective abrasive. Industrial Diamond Div., Engelhard Hanovia, Inc. (Circle 469) . . . A complete list of sizes and specifications on a line of adjustable roller burnishing tools is presented in bulletin RB-17. The Gustav Wiedeke Co. (Circle 470) . . . A four-page guide contains condensed information on materials for finishing operations and has a section on additives and specialties for bright plating processes. The Lea Mfg. Co. (Circle 471)

Fluid Power

Fluid Power News No. 13 describes and illustrates the solution of varied engineering problems through application of fluid power equipment. The Oilgear Co. (Circle 472)

Gearmaking

Four-page brochure H60-6 describes and illustrates the honing principle and a new gear honing machine. National Broach & Machine Co. (Circle 473)

Heat-Treating

Twelve-page bulletin 71-TH-1960 describes a line of high temperature, recirculating, gravity and forced convection ovens. Trent, Inc. (Circle 474) . . . Bulletin SEC-9 describes and illustrates a multipurpose, automatic furnace. Sunbeam Equipment Corp. (Circle 475) . . . A technical bulletin contains data on two new quenching oils. Industrial Products Dept., Sun Oil Co. (Circle 476)

Inspection & Measurement

A 10-page folder details a magnifying comparator for use with miniature parts and assemblies. Finescale Co. (Circle 477)

Lubricants & Coolants

Six-page "Spraymist Bulletin" illustrates and explains application methods for a variety of machining operations.

Bijur Lubricating Co. (Circle 478) . . . A technical bulletin describes a semi-fluid extreme-pressure lubricant for use where stiff greases are unsuitable. Industrial Products Dept., Sun Oil Co. (Circle 479)

Machine Mounting

Bulletin 602 is a six-page presentation of dimensional information and application data on a line of leveling screws. The Ohio Nut and Bolt Co. (Circle 480) . . . Bulletin 60-04 and 60-05 discuss installation of machinery and

the maintenance of absolute levels in precision applications. Barry Controls Inc. (Circle 481) . . . Protection of equipment against shock and vibration is discussed in bulletin 59-04.5. Barry Controls Inc. (Circle 482)

Materials

Sixteen-page catalog DH-1226-A covers company facilities for providing pre-shaped wire for varied applications. American Chain & Cable Co., Inc. (Circle 483) . . . Technical bulletin 12-10 is a guide to selection of steel tubing. Joseph T. Ryerson & Son, Inc.



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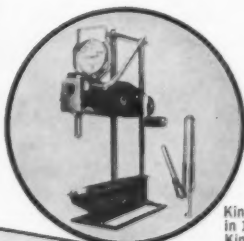
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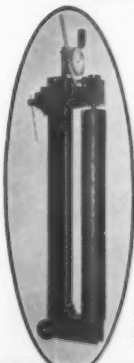
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(Circle 484) . . . A four-page technical bulletin contains weight comparison tables for welded steel tubing and solid bars. The Standard Tube Co. (Circle 485) . . . Data chart, Sec. F. No. 7, covers the dimensions and weights of steel pipe. Peter A. Frasse & Co., Inc. (Circle 486) . . . Technical information is provided in an eight-page report, "Fabricating Qualities of Pre-Finished Metals." Apollo Metal Works. (Circle 487) . . . "Carbides of Elements of the Fifth Group of the Periodic Table Bonded with Steel" is the title of a nine-page reprint. Sintercast Div., Chromalloy Corp. (Circle 488) . . . Technical bulletin 30-1 is a 20-page, illustrated fact book and buyers guide for aluminum products. Joseph T. Ryerson & Son, Inc. (Circle 489) . . . The lead article of "Steel Horizons News," Vol. 4, No. 6, highlights the company's new tool steel marketing plan. Allegheny Ludlum Steel Corp. (Circle 490) . . . "Tool Steels" is a basic guide to the use of tool and die steels. Climax Molybdenum Co., Div. of American Metal Climax, Inc. (Circle 491)

Pressworking

A line of rotary benders is described in a 16-page illustrated catalog. Wallace Supplies Mfg. Co. (Circle 492) . . . Twenty-four page catalog 6-60 describes and illustrates a line of mechanical and hydraulic presses and press brakes. Verson Allsteel Press Co. (Circle 493) . . . Catalog No. 60 is a 56-page, illustrated presentation of a line of hydraulically operated metal working presses for a variety of operations. W. A. Whitney Mfg. Co. (Circle 494) . . . A 36-page catalog covers a variety of punches and piercing accessories manufactured to ASTM standards. Pivot Punch and Die Corp. (Circle 495)

Sawing & Shearing

A unit that machine finishes as it cuts is described in a four-page folder. Wallace Supplies Mfg. Co. (Circle 496) . . . Twelve-page bulletin 70G covers a line of redesigned ring, circle, slitting shears and flangers. Niagara Machine & Tool Works (Circle 497)

Turning

Tool posts and toolholders for any lathe are described in a four-page bulletin. Rhucor. (Circle 498)

Workholders & Fixtures

Catalog No. 460 describes and illustrates a redesigned single spindle bar and chucking automatic machine. The Cleveland Automatic Machine Co. (Circle 499)

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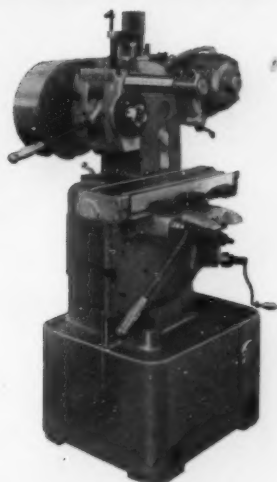
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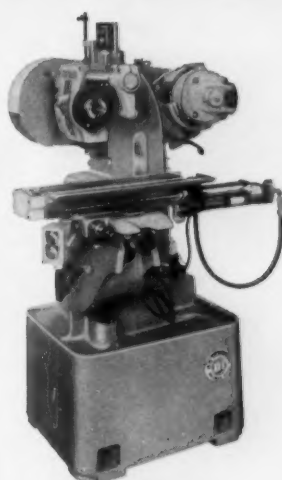
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STANDARD MODEL—A precise, versatile Hand Miller with Rise and Fall spindle. Table size 6 $\frac{3}{4}$ " x 21".



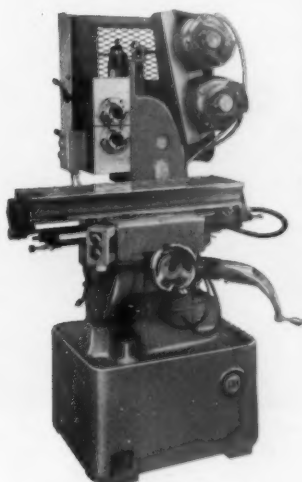
TOOL ROOM MODEL—Large 8 $\frac{1}{2}$ " x 30" table equipped with Micro Screw and Lever Feed. Extremely accurate and adaptable.



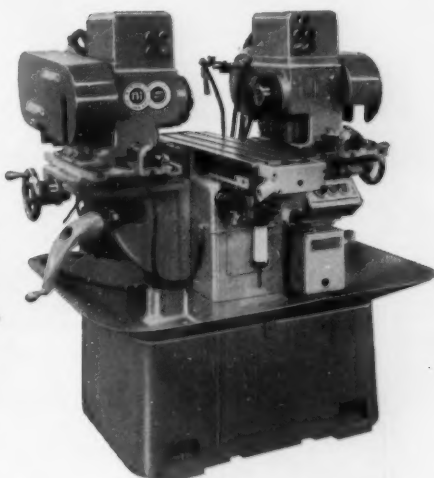
6SA SEMI-AUTOMATIC—Automatic pneumatic table feed converts Standard Model to a fast high production unit.



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Resignation of M. W. Saxman as president of Latrobe Steel Co. with his continuance as chairman of the board, and the elevation of J. E. Workman, left, executive vice president, to the presidency, was recently announced by the company's board of directors. Retirement of Saxman as chief executive officer culminates his 36 years of service with the company.

Herbert T. Florence, right, has been elected president and general manager of The Cleveland Crane & Engineering Co., Wickliffe, Ohio. He succeeds Charles F. Safreed who has been made chairman of the board. Also advanced was William J. Ryan, now a vice president and assistant general manager. Ralph Ford, plant superintendent, is now also assistant secretary.



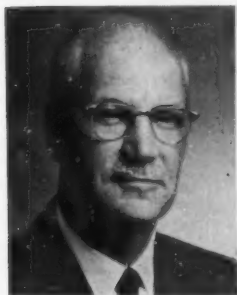
Men at Work

ROBERT D. BLACK, chairman of the board and president of The Black and Decker Mfg. Co., has announced an action of the company's board of directors to realign the top management organization of the power tool firm. Under the new alignment of Black & Decker top management, Black continues as chairman of the board, chairman of the executive committee and a director, and will be the chief executive officer of the company. ALONZO G. DECKER, formerly executive vice president, succeeds Black as president. He will continue as a director. Succeeding Decker is W. GRIFFIN MORRELL, vice president and director of The Chesapeake and Potomac Telephone Co. of Maryland and a director of Black & Decker since 1957.

DR. CHARLES D. BRADLEY, president of Bradley Semiconductor Corp., has announced the appointment of THOMAS C. PRIDMORE as chief engineer. Previously manager of Industrial and Entertainment Sales for Westinghouse Semiconductor, Pridmore will be in charge of all engineering activities for Bradley Semiconductor. He will be located at the New Haven, Conn., plant.

O. L. GIAUQUE has been appointed plant manager of Dana Corp.'s Auburn, Ind., Div. He succeeds RENE C. MCPHERSON, recently named executive vice president of Dana's Canadian subsidiary, Hayes Steel Products, Ltd., Merritton, Ont.

Appointment of G. A. SAAR as general manager, mechanical departments, and of W. M. TERRY, JR., as general manager, electrical departments, has been announced by Allis-Chalmers Industrial Equipment Div. Saar, who had been assistant general manager of the Industrial Equipment Div., is now responsible for operations of the processing machinery, compressor and West Allis pump departments. Terry, director of engineering coordination for Allis-Chalmers Industries Group since 1957, is now responsible for the operations of Norwood, Ohio, Works, including the electrical and pump departments there, and the control and industrial systems departments and rectifier section at the West Allis Works.



Gordon Patterson, Detroit industrialist, has been elected president and a director of The Yale & Towne Mfg. Co. Patterson, who previously served as president of Square D Co., succeeds Gilbert W. Chapman, who retired after 11 years as president of Yale & Towne. Patterson is the seventh president in the company's 92-year history.



Charles N. Hall has been named chief grinding engineer for The Heald Machine Co. He succeeds Clifford G. Menard who has been named consulting engineer for the Engineering & Research Departments. Hall served most recently at the company's Detroit office. He previously was in charge of the Heald Research Shop.



Rhode Island Spring Products, Inc., has announced the appointment of Paul J. D. Baltzer as vice president and general manager. Baltzer has been active in the metalworking industry for more than 20 years. For eight years he has served as manager of the O. W. Hultgren Mfg. Co., recently acquired by R. I. Spring Products.



Michael J. Fink, chief engineer, has been elected vice president of the Engineering Dept. of Mechanical Specialties Co., Los Angeles, Calif. Fink joined the company as chief engineer in June, 1959, after seven years with Acme Machine Works, where he was assistant to the general manager. He holds degrees from Stanford.

Men at Work

ROYDEN WALTERS, executive vice president and general manager of Saco-Lowell Shops, has been elected to the board of directors of the 147-year-old Boston-based manufacturing firm. He was elected to fill the vacancy created by the death of JOHN E. JOHNSON. Walters first joined Saco-Lowell in 1958 as executive assistant to the president; was made vice president and later executive vice president in 1959 and general manager last June.

J. E. MARTIN, president of Dana Corp., has announced the appointment of JOSEPH E. STARICH as general manager of the company's wholly-owned subsidiary, General Drop Forge Corp. Starich assumes the post of general manager after having served General Drop Forge for some time as general superintendent.

WILLIAM C. HEARD has been elected to the post of vice president-sales for the Capewell Mfg. Co., Hartford, Conn. He will continue direction of the national sales engineering staff.



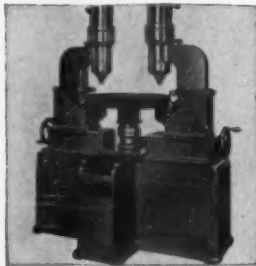
Richard E. Kregel was elected vice president and a member of the board at a recent board of directors meeting of Ex-Cell-O Corp. of Canada, Ltd., London. Kregel, an executive with 31 years of service with the corporation, was appointed general manager of Ex-Cell-O of Canada in 1957. The Canadian firm is a wholly-owned subsidiary of Ex-Cell-O Corp., Detroit.

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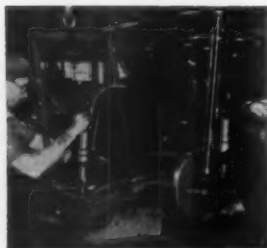
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Douglas D. Brien has been named president of the Ohio Gear Co. He succeeds Harrison Browning, who has been appointed chairman of the board, after serving 33 years as president. Brien's appointment culminates 14 years of service with the company. He has served as executive vice president since 1949. He was formerly with Chrysler Corp. and Fruehauf Trailer Co.

DONALD K. SKOOG has been appointed to the newly created position of director of engineering, Remington Rand Systems-Photo Records Div. of Sperry Rand Corp. Prior to joining the company, Skoog was, for six years, director of research for the Thor Power Tool Co., Aurora, Ill. He has also held engineering positions with Armour Research Foundation, Hughes Aircraft Co. and the Lockheed Aircraft Corp.



James E. Norcross has been elected to the board of directors of the Arcos Corp., Philadelphia manufacturer of welding electrodes and welding equipment. Norcross, executive vice president of the company, fills a vacancy left by the recent death of Royal D. Thomas. Norcross has been with Arcos since 1942, starting as production superintendent.

The appointment of ALEXANDER W. McPHERSON as product development engineer has been announced by Detroit Stamping Co. His primary responsibility will be to institute an expanded development program to enlarge and improve on the company's complete line of finished products.

JOHN P. G. PATTON has been elected secretary and a member of the board of directors of The Cleveland Cap Screw Co. He succeeds as secretary THOMAS A. FRIBLEY, recently elected president.



Election of William McGrath to the board of directors of The American Tool Works Co., has been announced by Robert S. Alter, chairman of the board. An executive of The Williamson Co. for almost 30 years, McGrath has been chairman of the board of that organization since 1959. He has been active in the field of labor-management relations.

September 1960



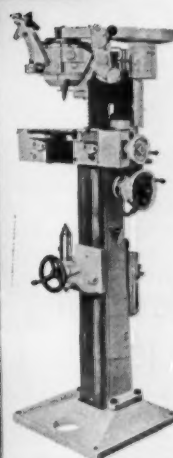
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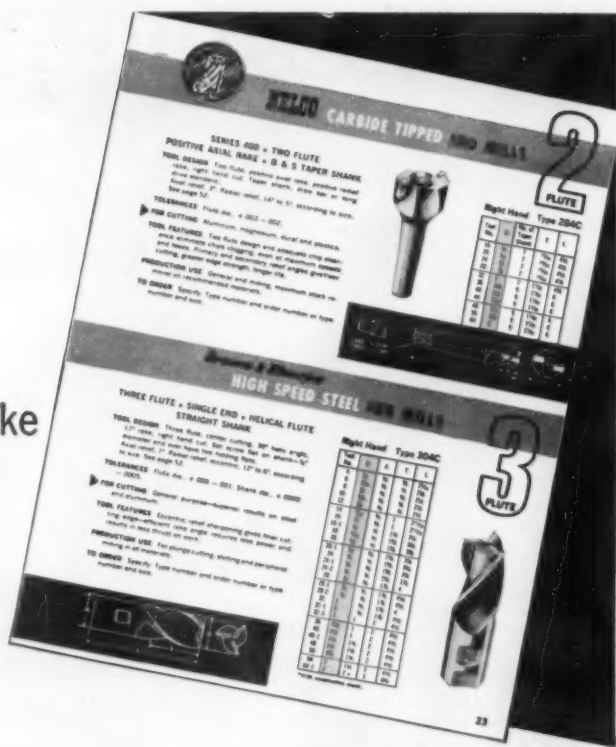
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Men at Work



Detroit Controls Div. of American-Standard has named James A. Kozel manager of product engineering for all products in the appliance, heating, air conditioning, refrigeration, industrial and thermo-controlled actuator fields. Kozel has been chief engineer of the Appliance Controls Div. of Scoville Mfg. Co., Chicago, for the past four years.

New executive appointments in the engineering, sales and production departments of the Gleason Works have been announced. RAYMOND W. DOELL, vice president, assumes overall administration of engineering activities as engineering manager of the firm. ROBERT F. PICAGE has been appointed chief engineer of the company's newly organized Basic Engineering Research Section.



Gordon W. Smithson has been named chief engineer of Pratt & Whitney Co., Inc., according to an announcement made by Jacob J. Jaeger, president. In this new position, Smithson will be responsible for all engineering activities of the company. Guy H. Drewry will continue as manager of engineering and be responsible for administration activities.

Field Notes

The Ford Foundation has awarded a grant of \$700,000 to the **Polytechnic Institute of Brooklyn** to establish an honors program in science and engineering. Under the new program exceptional students will be able to receive a doctorate in six years of full-time study. At present, science and engineering students generally take from eight to ten or more years to receive doctorates.

The Circle W trademark of the **Westinghouse Electric Corp.** has been redesigned for the fifth time in the 74-year history of the company "to keep the symbol modern and to improve our corporate identity," said Howard S. Kaltenborn, vice president-assistant to president. The logotype—the way the word Westinghouse is printed in corporate communications, advertising, signs and name plates—also has been redesigned so that it is compatible with the new trademark.

acquisitions

Rhode Island Spring Products, Inc. of Providence, R. I., has announced purchase of the **O. W. Hultgren Mfg. Co.** No changes in operating personnel are planned. All product lines of the Hultgren organization will be continued. Projected plans include expansion and modernization of production facilities.

Veet Industries, East Detroit, has acquired the **Sourant Mfg. Co.**, Belleville, Mich., manufacturer of hydraulic and air cylinders and pumps, precision parts, welding guns and automation machines. Sourant becomes the hydraulics division of Veet, but retains the name, Sourant Mfg. Co.

Miniature Precision Bearings, Inc., Keene, N. H., has announced the acquisition of **Carter Engineering Co.**, Ferrysburg, Mich., manufacturers of the patented "Alinabal" series of rod ends, spherical bearings and ball linkage devices. The company, including its manufacturing operations, will be transferred to the SBB plant in Lebanon, N. H. later this year.

moves

Bradley Semiconductor Corp., formerly Bradley Laboratories, Inc., has moved into new headquarters at 275 Welton St., Hamden, Conn. According to Dr. Charles D. Bradley, founder-president, this is a major step in an overall expansion program of increasing participation in the semiconductor components and electronic equipment field. The new facilities provide for more efficient production, research, development, testing and shipment of electronic components and equipment for Bradley's electrical, electronic, aircraft, missile, machine and tool, radio and television and other manufacturing customers.

A. J. Gerrard & Co., manufacturer of steel strapping and supplies, has moved to a new plant at 400 E. Touhy Ave., Des Plaines, Ill. The 80,000-square foot plant is twice the size of Gerrard's former plant in Melrose Park, Ill. It houses automatic production facilities for the manufacture of steel strapping plus the latest equipment for producing the company's line of strapping tools.

new facilities

A 14-acre tract of land in Solon, Ohio, has been purchased to provide new manufacturing facilities for the **Master Power Corp.**, air tool subsidiary of The Black & Decker Mfg. Co. Contracts have been awarded to The Austin Co. of Cleveland for construction of the facility. Providing 50,400 square feet of manufacturing and office space, the factory and office building will cost approximately \$700,000.

Philco Corp. has announced the opening of its midwestern Computer Div. office in The Merchandise Mart. The office will serve a 15-state midwest sales area and Charles R. Burke will be regional sales manager. The regional office will be area headquarters for Philco sales representative, systems and procedures analysts, instructors, programmers, coders and other sales support personnel for the 15 state area.

Manufacturing facilities for the production of standard and special cutting tools have been completed at Bedford, Ind., by the **Q-T Co.** The new plant has rail and truck facilities for overnight service to nearly all major mid-west industrial centers.

new activities

Establishment of an International Div., with headquarters in Cleveland, Ohio has been announced by **Parker-Hannifin Corp.**, Cleveland. A subsidiary of the new division, to be called Parker-Hannifin, n.v., located in Amsterdam, Holland, will function as a sales outlet, warehousing distributor, and service facility for Europe. Named to head the new international operation is Paul F. Smith, formerly president of Parker Seal Co. Div. of Parker-Hannifin Corp. in Culver City, Calif.

A new "total" leasing plan covering the complete line of American-Standard air conditioning, industrial and power equipment products has been announced by **American-Standard Industrial Div.**, Detroit, Mich. The new plan includes all types of nonexpendable equipment in the full range of sizes produced by the division, whether the purchased goods be standard off-the-shelf items or a complete custom installation.

mergers

Ling-Altec Electronics, Inc., and Temco Aircraft Corp. stockholders have voted to combine the two firms into **Ling-Temco Electronics, Inc.** Temco shareholders approved the combination plan for Temco to sell its assets in exchange for Ling-Temco stock, which will be distributed to Temco shareholders. Tempo Aircraft Corp. now becomes Temco Electronics & Missiles Co., a subsidiary of Ling-Temco Electronics, Inc., with the same internal structure, officers and assets as the original company.

Announcement has been made by Frederick C. Schafer, chairman of the board of **Imperial Brass Mfg. Co.**, and

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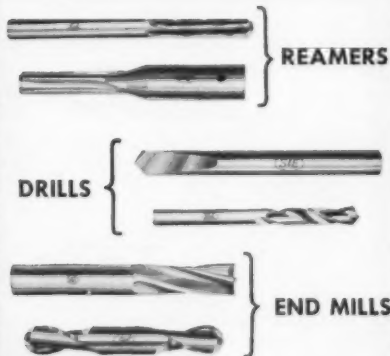
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Field Notes

Walter C. Schuknecht, president of Eastman Mfg. Co., that a merger of the two has been approved by the boards of directors of both companies.

awards

Peter John Sereda, Division of Building Research of the National Research Council of Canada, Ottawa, recently received the Sam Tour Award at the 63rd annual meeting of the **American Society for Testing Materials** at Atlantic City, N. J. Sereda received the award for his paper, "Measurements of Surface Moisture," published in the ASTM Bulletin, February, 1958.

Robert S. Stevenson, president of Allis-Chalmers, recently presented his company's first Scientific and Engineering Award to William L. Ringland, chief engineer of Allis-Chalmers motor and generator department. It consisted of a fine-silver medallion, certificate and \$5,000 for his invention of a new way of transposing conductors in large generators.

expansions

John P. Spain, general manager, Product Service Div., **The Black & Decker Mfg. Co.**, has announced the opening of a new Black & Decker factory service branch to serve the rapidly-growing electric tool market in the San Diego, Calif., area. The branch is located at 3811 El Cajon Blvd.

Linde will further expand its oxygen-producing facilities this year with the installation of a new on-site plant in Pueblo, Colo. Start of construction was announced by William B. Nicholson, president of **Linde Co., Div. of Union Carbide Corp.** One of the nation's larger on-site plants it will supply more than 200 million cubic feet of oxygen per month to the Colorado Fuel and Iron Corp. Pueblo plant.

name changes

P. R. Mallory & Co. Inc., Indianapolis, has announced that its **Electronic Timers Co.** became the Mallory Timers Co. on September 1. One of ten operating divisions of the parent company, the Electronic Timers Co. was established in 1954 to manufacture sequence timer switches for the appliance industry.

Industrial Diamond Div. of Engelhard Hanovia, Inc. has been established as the complete corporate title of that division of the company.

association news

A proposed AGMA *Gear Classification Manual for Spur, Helical and Herringbone Gears* (No. 390.01) was presented at the 44th Annual Meeting of the American Gear Manufacturers Association. The special task force that prepared the manual is headed by C. R. Burrell, Tool Steel Gear and Pinion Co. It is expected that the manual, which is currently being reviewed by AGMA members, will be accepted by the membership. It may be ready for release sometime this month.

Fourteen classes of gears are listed in the manual, which was prepared to make it possible for purchasers of gears to select gears according to a quality class based on use.

The new manual will make obsolete those parts of AGMA Inspection Standards No. 231.02 and 236.04 that deal with accuracy classes of gears. The balance of these standards, while usable, are considered to be in need of revision.

New inspection standards that are compatible with the *Gear Classification Manual* will be prepared as soon as possible. In the meantime, errata sheets for standards 231.02 and 236.04 will be issued.

The AGMA Measuring Methods and Practices Committee, under the chairmanship of F. L. Heine, Milwaukee Gear Co., has accepted a proposal by L. N. DeVos, Ford Motor Co., to set up a group of eight inspection classes. These classes will cover the type and degree of inspection to be used for the specific quality classifications covered in the *Gear Classification Manual*. Members of the Committee are developing the inspection classifications. It is hoped that they will be ready for presentation to AGMA members within the next 18 months.

Noah E. Hull, vice president and general manager of the Hughes Gun Co. and assistant to the vice president, manufacturing, of the Hughes Tool Co., has been elected president of the National Society of Professional Engineers. Also elected were six regional vice presidents: W. Earl Christian, New Brunswick, N. J.; R. King Rouse, Greenville, S. C.; Benjamin G. Elliott, Madison, Wis.; Brandon H. Backlund, Omaha, Neb.; Thomas T. Mann, Roswell, N. M.; and John H. Stufflebean, Tucson, Ariz. Russell B. Allen, Silver Spring, Md., was elected treasurer.



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Machine Tool Exposition
September 6-16, 1960

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Exposition



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A25

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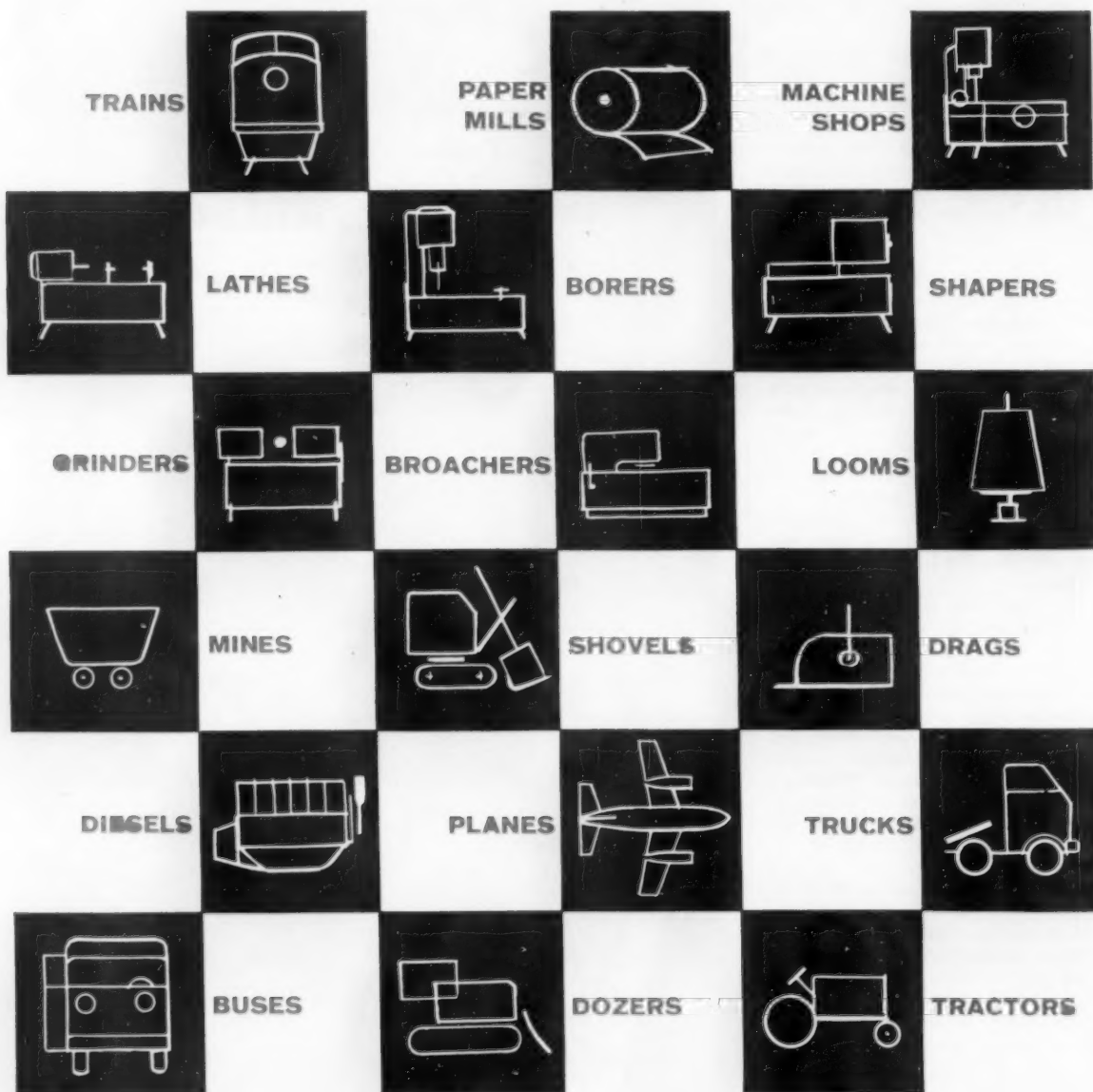


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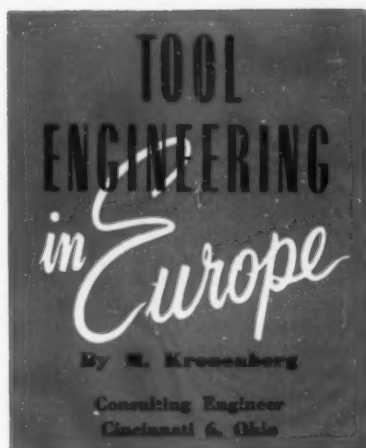
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Machinability Testing

The unsolved problem of short-time testing of machinability is discussed in an article by H. Koelzer and K. H. Marten, published in *Werkstatt Technik*, No. 6, 1960. The title of their article is "Anwendungen Moeglichkeiten und Grenzen des Schnittgeschwindigkeits Steigerungs Verfahrens, eines Kurzpruefverfahrens der Zerspaubarkeit" ("Possibilities and limitations of the method of increasing cutting speeds as a means for short-cut testing of machinability").

The authors show that machinability cannot be successfully determined by steplessly increasing cutting speed (the S.I.C.S. method) in cases where metals of different chemical composition are to be tested. On the other hand, when the machinability of different types of metals of the same chemical composition—such as the carbon steels or the chrome-nickel steels—must be determined, the authors recommend the S.I.C.S. method. This method has, in the past, been applied as a face turning operation. Koelzer and Marten have developed an S.I.C.S. method based on longitudinal turning.

Tensile strength of metals has a dominant effect on machinability when the S.I.C.S. method is used, rendering it inadvisable to use this short-cut method in cases where the same tensile strength applies to metals of different chemical composition.

The agreement between the long-time and the short-time methods is better when based on crater wear than when based on flank wear. (While both crater wear and flank wear are taken into consideration in European tool life tests, it is customary in the United States to depend on the flank wear when determining tool life.)

The article is illustrated with a diagram showing the relationship between shear stress in the shear plane and tensile strength. These are substantially identical according to the authors.

Relative machinability can be determined within the following groups of metals, but not from group to group: carbon steels, bar stock, chrome-nickel steels, and chrome and chrome manganese steels.

Special Twist Drills

Tool life, measured in terms of total length of holes, increased 25 to 30 percent when drilling premachined cast iron with twist drills having a special point. H. L. Hall, W. Grehn and A. Wunsch have run tests in an automotive plant and published the results in *Werkstatt Technik*, No. 6, 1960, p. 305 to 309.

The tests covered 261,000 holes drilled in cast iron alloyed with chrome and nickel, 88,000 holes in unalloyed cast iron and about 100,000 holes in different types of malleable iron.

The improvement in tool life was 95 to 100 percent in cases where the entrance and exit surfaces were not premachined, except for drills of less than about $\frac{3}{8}$ -inch diameter, where tool life improved only 15 percent.

Cost of regrinding the special drills is higher than those for conventional drills and adversely affects the economy of the drilling operations, although a cost advantage still exists when drilling into unmachined surfaces. Cost comparisons are based on European wages and overhead rates and may be different in American production.

Milling Machine Vibrations

Elimination of chatter arising during face milling operations is of considerable practical importance because of its adverse effect on tool life, surface finish and control. An investigation into these problems has been carried out by S. A. Tobias and the results published in *Proceedings of the Institution of Mechanical Engineers*, Vol. 173, No. 18, 1959, p. 474 to 493 (London, England) under the title "Vibrations of Vertical Milling Machines under Test and Working Conditions." Discussions by several other investigators appear on p. 495 to 510.

The investigation consists of three parts and, although one may not agree with all of the author's conclusions, the paper is thought-provoking and educational.

Part I is concerned with experiments carried out on the vibration of vertical milling machines. It is shown that the machine structure has five modes

of vibration within the frequency range that was investigated. The dynamic deflections corresponding to the recorded amplitudes are discussed and attention is called to certain structural weaknesses frequently encountered in vertical milling machines, such as the opening in the back of the column to accommodate the motor.

Part II deals with various experiments concerned with face milling chatter. It was found that the severity of chatter depends on the relative position of cutter and workpiece and the depth of cut. This agrees with findings by this writer. When the depth of cut exceeds a certain minimum value, the milling machine chatters in definite "speed bands," which are separated by chatter-free speeds. As the depth of cut is increased, the chatter-free bands contract. The author concludes that the observed chatter is of a feedback or regenerative type.

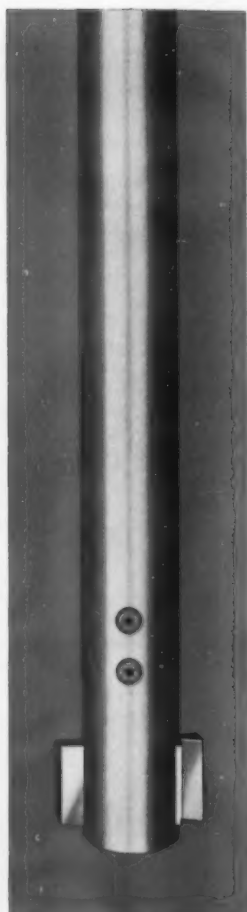
In Part III a theoretical interpretation of the test results is discussed and a three-dimensional stability chart presented. The constants required for the design of such a chart are obtained from the experiments and may vary with the design of the machine, tool geometry and other such quantities.

Milling Machine Drives

A somewhat different approach to the problem of milling machine vibration than that presented by S. A. Tobias is taken by M. B. Paley in an article published in *Stanki i Instrument* and translated into English in *Machines and Tooling*, Vol. 31, No. 1, 1960, p. 3 to 11, under the title "Some Dynamic Properties of Milling Machine Drives."

While Tobias confined his attention to vibrations generated by the cutting process itself (namely, to self-induced vibrations and vibrations due to the geometry of the milling operation) Paley considers the strong forced vibrations in the main drive of a milling machine. He refers to data on the effect of fly-wheels on the reduction of the instability of the milling machine spindle, where the cutter wear was reduced by 20 to 40 percent and the surface finish improved 25 to 40 percent.

The author converts the gear drive—and a comparative belt drive—into shafts of equivalent torsional rigidity, a method used in the United States as long as 20 years ago. He introduces a "spindle rotation instability coefficient" and a "coefficient of cutter overlap." He feels that the belt drive has a high damping capacity. In the case of a gear drive, the author's tests resulted in the finding that torsional vibrations caused by the cutter tooth engaging the workpiece are completely



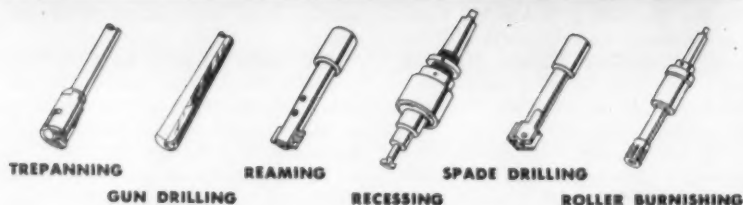
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damped before the next tooth comes into contact with the metal.

The minimum admissible angular speed of the cutter is determined from the linear speed of the belt to ensure stable (that is vibration-free) operation of the drive. The author also derives formulas for the amplitude of vibration and the maximum torsional angle, and concludes that an increase in the elastic slip of the belt helps to reduce the instability coefficient.

The experimental setup to check the derived equations included a toothed disk attached to the spindle and an induction pickup, with the teeth of the disk passing the pickup as the spindle rotated.

Grinding Temperatures

In high-speed cutting the heat from the chip has no time to be transferred to the workpiece, according to an article by S. G. Redko in *Stanki i Instrument*, translated into English in *Machines and Tooling*, Vol. 30, No. 21, 1959, p. 31 to 35. The title: "Calculation of Temperature of Ground Surfaces."

The author derives formulas for heat distribution between abrasive grains and machined surfaces, and for the accumulation of heat on ground surfaces. In addition to the theoretical derivations, Redko has also run tests using an indirect method to establish the temperatures of the ground surfaces. In this method, the depth of the layer of the Martensitic-Austenitic transformation in the microstructure of the ground surfaces is compared with the surfaces of the abrasive grains.

Redko's conclusions include the following findings: The size and degree of heat of a chip removed by one grain does not show any influence on the temperature of the ground surface. Changing the depth of cut and feed causes a change in the number of thermal impulses. The temperature of the metal remains constant in the exit zone of the grains, independent of the size and temperature of the chips. Temperature of the ground surface increases with the depth of cut and reduction in the feed rate.

Fine-grain wheels heat the surface less than coarse grains in the case of small depth of cut or fast feed. Heat increases with an increase in depth or lower feed rate using fine-grain wheels. The accumulated temperature drops with increasing peripheral speed of the wheel, number of grains per square inch and increase in the arc of contact.

The Tool and Manufacturing Engineer

technical shorts

Hydrogen embrittlement, often a problem when high-strength steel is plated, is eliminated in a new process developed by Minnesota Mining and Manufacturing Co. Called the "Mechanical Plating System," the new method is designed primarily for the application of protective metal coatings. Present commercial installations licensed to plate with this process are using it to apply zinc coatings. However, research is being conducted to extend its application to cadmium and other materials.

Plating Process Eliminates Embrittlement

Procedure in using Mechanical Plating is basically simple. Parts to be coated are rotated in a rubber-lined tumbling barrel with water, special chemicals, impact media and a prepared plating metal in powder form. Tumbling cycle is approximately 45 minutes for this operation.

This method of plating is essentially a process of cold welding. The impact media, which is composed of glass particles, consolidates and welds the metal powder to the work in a dense continuous coating. No subsequent baking or chemical processing is required in Mechanical Plating.

An interferometer developed several years ago for measuring the parallelism of gage blocks can also be used to compare gage-block lengths. Use of the interferometer eliminates wringing which is injurious to gage-block surfaces. In addition, because blocks are measured in a horizontal position, the usually necessary corrections for gravitational distortion can be dispensed with.

Interferometer Calibrates Gage Blocks

As in other interferometers, two beams of light originating from the same source travel different paths and then cross. In crossing, they form a pattern of interference fringes, the order of interference depending on the difference in optical path length. The parallel-testing interferometer, which was developed for the National Bureau of Standards, is actually an instrument containing two such inteferome-

ters, one for each end of the block. If block surfaces are parallel, fringe patterns will also be parallel.

In applying this instrument to length comparisons, two gage blocks are placed side by side and each set of fringes is formed by the superposition of the images of neighboring ends. The order of interference at the center of each pattern formed is a measure of the relative position of the two end faces. The difference between the two orders of interference is a measure of the difference in the length of the gage blocks.

Installation of an exceptionally large molybdenum-rod hydrogen furnace for the firing of metallized ceramics has been announced by Mitronics, Inc., of Hillside, N. J. Approximately 18 ft long with an 8 x 10 in. opening, the furnace is capable of operating at temperatures in excess of 3200 F.

Furnace Fires Metallized Ceramic Parts

In operation the furnace is heated by molybdenum rods. Temperature is controlled by a radiation detector which is coupled to an indicating pyrometer. Cooling is provided by a water-jacket system within the furnace.

Mitronics has announced that the furnace will be used principally in manufacturing rectifier, diode, triode and other electronic components.

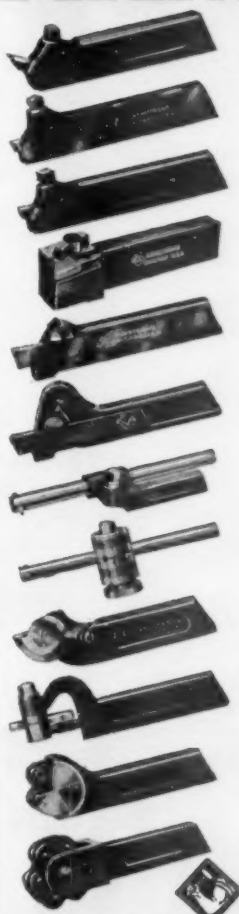
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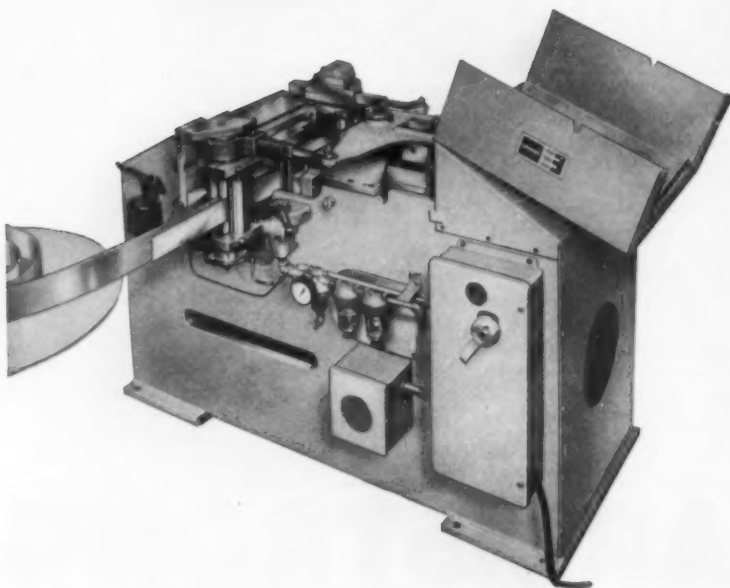
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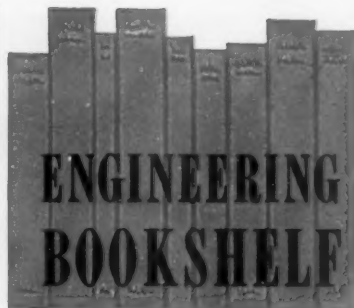
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MANUAL OF MACHINABILITY AND TOOL EVALUATION—By A. Niedzwiedzki. Published by Huebner Publications, 1975 Lee Rd., Cleveland, Ohio. Price \$6. 97 pages.

This manual provides a survey of metalcutting relationships in turning operations. Utilizing data gathered in Europe and America, the author deals with tool life, cutting force, power consumption, standards for machinability, tool inspection and related items.

Many interesting and valuable contributions to the science of metalcutting are presented in this book. Paramount among them is the establishment of a graphical relationship between tool wear and work diameter. This aspect of metal removal has received little attention in the past although research conducted by F. Eugene at the Laboratoire d'armement in Paris tends to support the author's conclusions. However, his claim to original derivation of a formula correlating unit cutting force and feed is suspect, and his attention is directed to the work accomplished by F. W. Taylor in this field.

A useful suggestion advanced by Niedzwiedzki is the possibility of standardizing chip breakers. This could be accomplished as a supplement to Hendriksen's research into the nature of chip curling and breaking.

The author's conclusions relative to the machining of austenitic metals should be of value to tool engineers. He advises reducing the duration of contact between the work and the tool. In addition, his "crossed chart" scheme for correlating rpm, feed and tool life will be useful to those interested in preparing machining standards for their own plants.

*Dr. Max Kronenberg
Consulting Engineer
Cincinnati, Ohio*

ENGINEERING DATA PROCESSING SYSTEM DESIGN—By Arthur D. Even. Published by D. Van Nostrand Co., Inc., Princeton, N. J. Price \$6.50. 282 pages.

Engineering departments of large companies require automation of data processing if effective liaison with re-

mote production lines is to be maintained. However, many engineering executives believe that modern data processing systems, while highly desirable, are unadaptable to problems peculiar to their firms. In many cases this is true, but only because the manual systems they use are incompatible with existing standards of good practice. No matter how complex a system is, its reorganization and adaptation to electronic machines can be effected.

This book outlines the procedures necessary to establish mechanization of data flow. As such, all phases of organization, training of personnel, system operation and control are discussed in detail. Actual installation of a successful system is described and sample cards are shown.

This book will prove useful to those who wish to introduce electronic data processing systems to their companies. It should be equally useful to others who find it necessary to streamline their existing data flow system.

MECHANICAL PRESS HANDBOOK—Published by *Metalworking Magazine*, 221 Columbus Ave., Boston 16, Mass. Price \$5. 247 pages.

Design and construction of metalworking presses with detailed analyses of all mechanical and electrical components is treated in this book. Auxiliary equipment such as stock-feeding devices for single and multiple-press operations is also discussed with emphasis placed on operator and machine safety.

Ample use of charts and diagrams will make this book especially useful to tool designers interested in the engineering aspects of press operation. All press variables such as slide speeds, draw speeds, tonnage requirements, etc., are charted. As such, they should do much to simplify press selection for any given stamping operation.

PHOTOMICROGRAPHY OF METALS—Published by *Eastman Kodak Co.*, Rochester, N. Y. Price \$.60. 46 pages.

Published as a reference guide for metallurgists, this booklet will also serve as a supplemental text for college-level metallurgy students. Six major sections include detailed information on metallographic microscopes, illumination, filters, photographic materials, exposure determination, and processing and printing.

Optics of metallography are discussed at length with specific suggestions and recommendations for matching equipment to application. Practical information is given on exposures for both black-and-white and color materials used in photomicrography.

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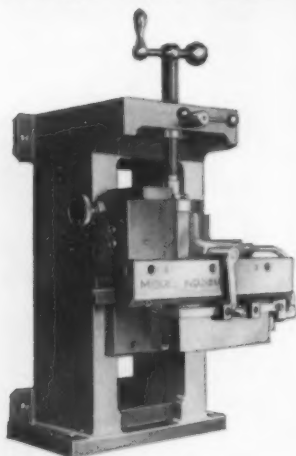
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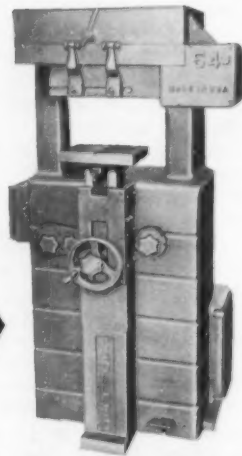
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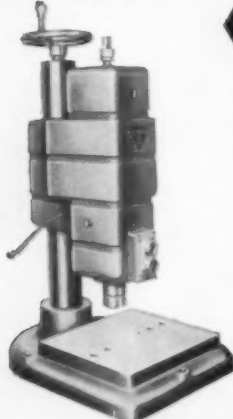
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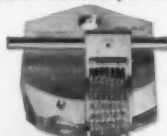
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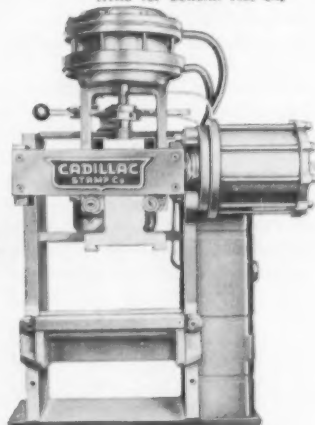


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Innovation and Obsolescence

Two factors that affect the level of industrial activity are invention, as of a typewriter or airplane that creates new industries, and innovation, that improves the function of some existing product. Innovation has been called "creative destruction" and "planned obsolescence" in referring to its effects on consumer replacement of products. Some abuse of the planned obsolescence concept has occurred. True innovation brings real value to the consumer in the form of an improved product instead of mere change without benefit. To provide a supply of real innovations, good planning includes a constant program of development to create a backlog of expandable projects, so that there is no need to change a product for change's sake, without real benefits.

Innovations have improved product performance, but the added features, by increasing components in a product, have sometimes decreased reliability. Service calls have increased and the total spent on service of appliances now averages more than \$70 per household per year. Design and manufacturing effort is required to produce a product more free of service.

Based on a paper by Robert E. Brooker, president, Whirlpool Corp., 1965 Porter, Detroit 15, Mich., presented at the National Appliance Technical Conference.



Improving Plant Layouts

Engineering a plant revision depends on careful planning for success and this in turn is dependent on the methods used in planning and carrying out the project. Whatever method is used requires that the gathered information be organized and systematically tabulated.

To accomplish this, a five-step procedure is described, with the forms used and examples. Step one is to make a product load analysis. Step two is to break down a representative model into its subassemblies and components. Step three is to make a route sheet based on information obtained in step two. Step four is to post from the work route sheet by machine centers. Step five consists of developing cross charts for solving the complex flow patterns and actual machine or work center relationships from which the revised layout is developed. This is the quickest way to obtain total distances moved for the existing layout.

At this point a criterion is applied: if the material handling savings will not recover cash outlay for modifying the layout, the project is not recommendable. If recommendable, additional analysis is made, and a three-dimensional model is made. As a final review of operations, an estimated financial statement is made for the new plan and compared with the preceding year's financial statement.

Based on SAE Paper 189A by N. L. Schmeichel, Sterling National Industries, Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.



Revising Plant Layouts

Reasons for changing a plant layout might be that new equipment is to be installed, existing equipment is to be removed, transposition of existing equipment is dictated by change in operation sequence, changes in availability of space have occurred, better utilization of available space is required, reduction of supervisory personnel is desired and can be accomplished by bringing together similar facilities, reduction of delay in waiting between operations is desired, or reduction of in-process inventory is desired.

For justification, clear and accurate cost figures are needed as well as answers to the questions: What do we gain? How much will it reduce operating costs? How long will it take to pay for it out of savings?

Three case histories are detailed to show methods of estimating costs and evaluating the gains. In the analysis, the number of months required to amortize the cost of new construction through increase in net profits after taxes is of considerable importance, but specific recommendations are not made.

Based on SAE Paper 189B by John McIntosh, Ernst & Ernst Management Services Div., Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

Stylii and Roughness Measurement

Surface finish ideally should be measured by an infinitely small stylus. The standard calls for a 0.0005-inch-radius spherical tip. Some investigators have reported differences in measurements using a stylus sharper than the 0.0005-inch tip called for in the standard, but also conclude that errors due to the standard type stylus were too small to justify the risk of marring and the short stylus life attendant with a sharper stylus. To investigate the effects of stylus tips on measurements, tests were conducted using several different radii on different surfaces. Results indicated that on lapped and polished surfaces a sharper stylus was of no great value. It is not the fineness of the surface that requires a sharper stylus, but some other characteristic. Coarse ground surfaces sometimes show more difference in reading due to stylus radius than fine ground surfaces. It is concluded that the characteristic requiring the sharper stylus could be the included angle of the scratches. Single-point tools usually have a wide angle or a nose radius blunter than the stylus, but grinding wheel grit could have a smaller included angle.

Based on SAE Paper 195A by Frank W. Kahat and Charles H. Good, Micrometrical Mfg. Co., Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.



Vinyl-Clad Metals

The advantages of plastics and metals are combined by the lamination of vinyl to a piece of metal by means of an adhesive. Each of the three components—the metal, the adhesive and the plastic—is critical; the laminate will be only as good as the weakest of the three members. Metal treatments perform two functions; the first is removal of surface contaminants and the second is prepa-

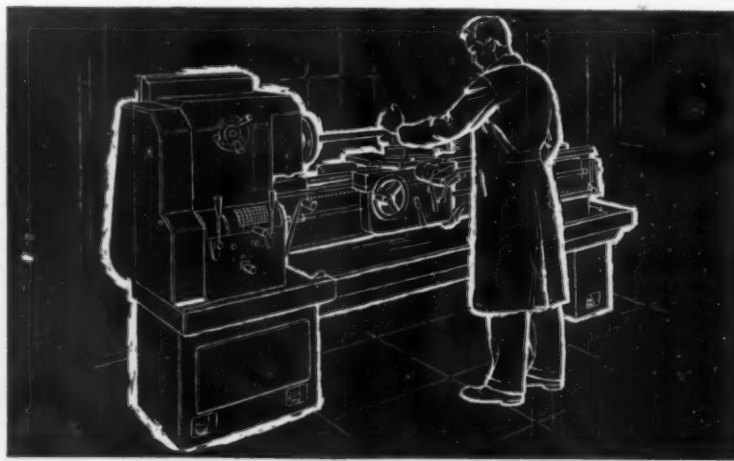
tech digests

ration of the surface for a complete bond. The metal surface must be absolutely free of water breaks; that is, it must be capable of being covered with an unbroken film of water. Thickness of the metallic phosphate coating must be rigidly controlled. Both thermoplastic and thermosetting adhesives are used, depending on end use of the laminate. Adhesives are applied by spraying or roller coating and then the solvents used in the adhesive are driven off by evaporating them in an oven.

The vinyl sheeting, made up in the exact formulation for the intended end use, is pressed against the hot sheet as it emerges from the oven. The vinyl and metal go through a pair of rubber combining rolls. The laminates can be supplied in long coils or in sheets. Forming operations that can successfully be performed include shearing, crimping, punching, drilling, brake-press bending, stamping, roll forming and cold drawing. Draft on deep draws is the same as required for the base

metal alone. A clearance of about 0.003 inch should be allowed for the thickness of the laminate. Lubrication used during forming should be water soluble so that the vinyl can be cleaned by a water rinse. The material can be welded using high voltage and split-second welding cycles. Welding times exceeding 1/50th second can damage the vinyl film.

Based on SAE Paper 180A by P. E. Roggi and C. E. Kiernan, Naugatuck Chemical Div., U. S. Rubber Co. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.



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Value Engineering Productivity

In a detailed report it was noted that \$19.6 million was realized in cost reductions by some 32 product departments from an estimated outlay of \$762 thousand. The average net yield after taxes by the trained value specialist at GE was \$148 thousand. Average ratio in dollars of yield to cost was \$25.72 to \$1. Yet it has been found that optimum value through fulltime use of Value Analysis is achieved only sporadically in most industry and business. Also, there has been no apparent orderly way of value engineering of end products. For many enterprises, the only real measurement of value has come in the market place, either through lost sales or too little profit to stay in business.

The need for value analysis is heightened by present labor costs and foreign competition. Presently, only some 40

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percent of American industry is using value analysis to any degree. Only by giving the customer more for less is it possible to achieve the objectives sought for the American economy. The price for a function is the factor and the best place to control this price is at the concept stage of a design and in prime stages of manufacture when we select manufacturing alternatives for producing functions.

If acceptance of value analysis continues to increase at the present rate, it will be possible to value engineer our whole industrial complex. This enables the prediction that the next few years will bring dramatic changes in the whole business community.

Based on SAE Paper 182A by John F. Prendergast, General Electric Co. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

Increased Use of Plastics

Future volume of plastics consumption will be affected by population growth, changed living habits, available income for improved living conditions and technological improvements in plastic materials and their application. A Census Bureau forecast indicates for instance that there will be an increase of approximately 40 percent in households by 1975. Considering the effect of these figures on one household appliance alone, it is anticipated that by 1970, around 205 million pounds of plastic will be used in refrigerators, approximately 60 million pounds more than is being used today. Another technological development that possibly will cause increased use of plastics for refrigerators is the development of semiconductor refrigeration techniques. When feasible, this would make possible the production of refrigerating units whose cost is directly proportioned to the refrigerator's capacity—enabling the use of several smaller refrigerators in a kitchen, each one located at the point of usage of its contents.

Realization of these consumption levels of plastic is partially dependent upon eliminating some previous problems in the use of plastics—misapplication of plastics, wrong materials specified for a particular part, parts incorrectly engineered and designed and lack of adequate quality control in production.

Based on a paper by Leland K. Warrick, Hotpoint Co., presented at the National Meeting of the Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.

Inspecting Taper Threads

A new technique for inspecting taper threads was developed for application on the rotary-shouldered connections of tool joints used in drill pipe for oil-well drilling. This technique also can be employed for inspecting taper threads for other applications and for cylindrical threads, which can be considered as taper threads having a taper equal to zero.

The final inspection of taper threads customarily is made with plug and ring gages, whose position on the product is affected by the cumulative effect of all thread-element errors. For accurate threads and good fits, these errors must be kept to a minimum. In production, the thread profile can be controlled easily and the usual inspection instruments (such as optical comparators, thread-contour microscopes, thread-

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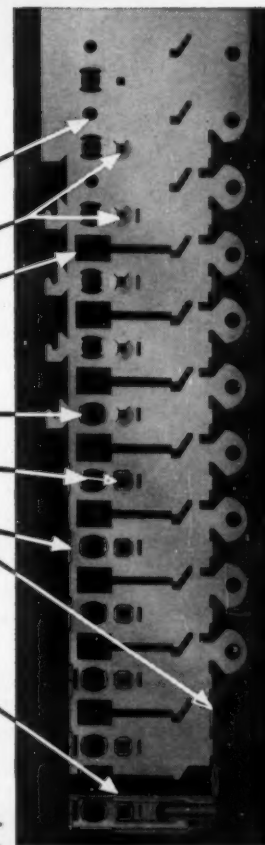
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height gages, and similar devices) are generally satisfactory. Also, since threads produced with standard procedures have rather uniform profile throughout the entire thread, inspection of thread profile in a single location in most cases is sufficient.

On the other hand, the existing methods for inspection of the other thread elements (lead, taper, roundness) and of the over-all geometric shape of the threads are rather cumbersome. Most of these methods measure one thread element at a time and usually in a single plane only. For determining the dimensions of the entire thread,

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and for obtaining a picture of the over-all thread configuration, measurements in a number of planes have to be taken.

With the new technique, simultaneous and continuous measurements of the variations of thread pitch-cone radius and the lead are obtained against an accurate taper and an accurate lead, respectively. The variations are registered electrically and recorded on charts.

The technique described provides a reasonably fast and accurate method for simultaneous and continuous determination of all element errors, except on profiles, and of the over-all geometric shape of the threads. The thread profiles must be inspected separately.

Based on ASME Paper 60-SA-6, by A. A. Mittenbergs, Battelle Memorial Institute; and Ned Rodgers, American Iron and Machine Works Co., American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.



Fundamentals of Technology

Two important areas of American business life have been the subject of much misinterpretation. First, the role of the individual in a large-scale organization and, second, the relationship of technology to the individual and to society have been misunderstood.

For the first, many observers conclude that the individual has become lost in the crowd and is no longer essential; actually, creative thinking is the province of the individual—association with a group does not relieve anyone of the need for individual initiative. In both large and small companies individual initiative and creativity is needed.

The Tool and Manufacturing Engineer

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Second, the growth of our technology sometimes is so fast that it is not well understood. Defined, technology is the sum total of all the tools and techniques that men have enlisted to multiply human effort. Modern technology is a force that brings together machinery and equipment, skills and techniques, men, money, and methods. But it has limitations. Tools were fashioned to aid, not to replace the human hand. Machines have weaknesses and, unlike man, do not have the means at hand to correct them. Machines are subject to a deadly disease, they are susceptible at all times to the insidious blight of obsolescence. Man, happily, has yet to become obsolete.

Based on a speech by Henry B. du Pont, vice president, E. I. du Pont, vice president, E. I. du Pont de Nemours & Co., Wilmington 98, Del., at the dedication of the New Science Bldg., Sul Ross State College, Alpine, Tex.

Trends in Aircraft and Missile Metal Removal Techniques

Transition to jet aircraft and missile production has meant a changeover from machining aluminum to machining steel and special alloys. Applications and limitations of milling, turning, drilling, tapping, grinding and nonmachining methods of metal removal are discussed. Metal removal rates, tool life, cutting fluids and other factors are indicated in tables and graphs for many of the different materials machined.

Based on SAE Paper 160A by Michael Field, Metcut Research Associates, Inc. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

Comparison of Steel Castings and Weldments

Steel castings and steel weldments are competitive materials employed in ferrous metal fabrications. They are at times used as replacements for each other in engineering structures, depending on the cost and quantity differential and the familiarity which the designer has in the material of construction and the service application of the particular engineering structure.

The studies of this research were undertaken with the express purpose of providing information on the design of steel casting and weldment sections and a comparison of the properties of these sections, so that the design engineer may be more familiar with the engineering characteristics of these two

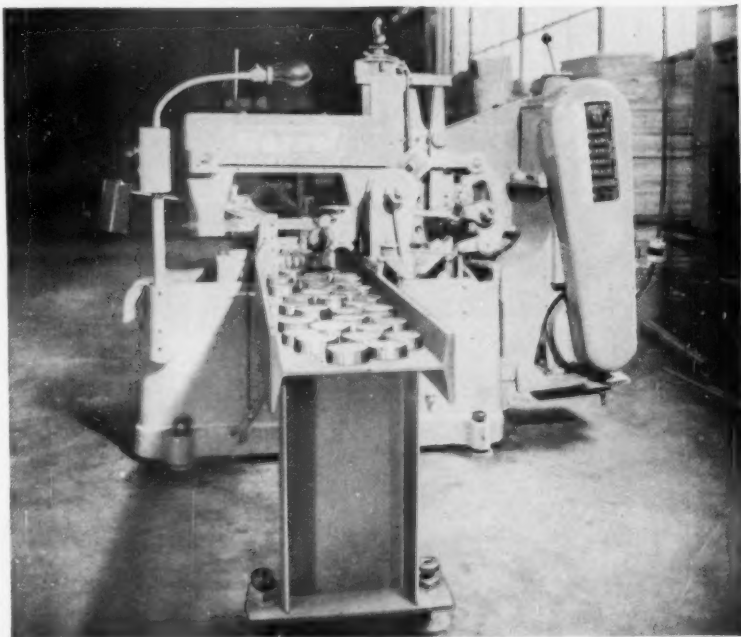
methods of fabrication for use in stress-carrying parts of engineering structures.

The L design produced as steel castings and weldments of wrought steel plates, was subjected to static and dynamic loads. The performance of these structures was then compared.

The L and box section test specimens employed in this research were manufactured by methods which are considered standard commercial practice for each process. The wrought and cast steels used were carbon steels normally

employed and generally specified for each particular manufacturing process.

It might have been desirable to have these two materials of comparable tensile strengths, but the essential requirement was that the study and the comparison of these materials should be based on normal commercial weldments and steel castings, as they are generally specified for similar service applications. The interest lies in a comparison of casting and weldment designs; not of cast steel and wrought steel plate.



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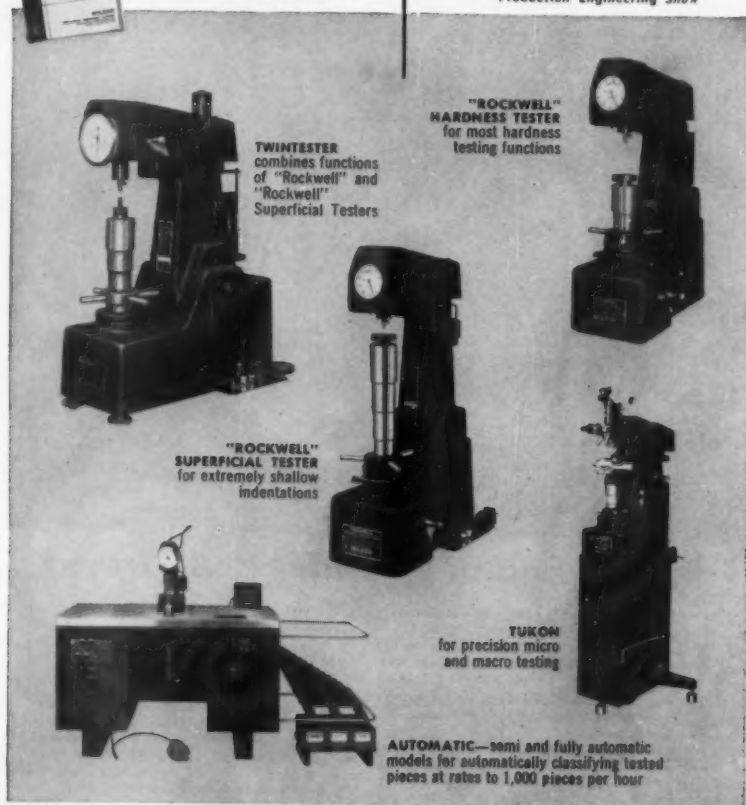
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This research encompassed a study of commercial products of fabrication; therefore, there was no selection made of the specimens to be tested. The cast and welded specimens were considered satisfactory for testing if they passed visual inspection by the producer.

Based on ASME Paper 60-SA-2, by Harry R. Nara, D. K. Wright, Jr., Case Institute of Technology, and Charles W. Briggs, Steel Founders Society. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

High-Energy Rate Forming

Closed-cavity extrusion molding is defined as the forcing of metal in a semisolid or plastic state through a small outlet (orifice) into a defined volume (die cavity) to produce a finished or semifinished configuration with high physical properties.

The application of high-energy rate to production is feasible—however, there remains a considerable amount of development work still to be accomplished. The several processes are sound with only detail information remaining to be gathered before specific parameters are established. It must be recognized that each method of applying high-energy rate has its own area of application. No one method is the panacea for the material processing industry. They should be applied only when the job cannot be done any other way, the finished product is better

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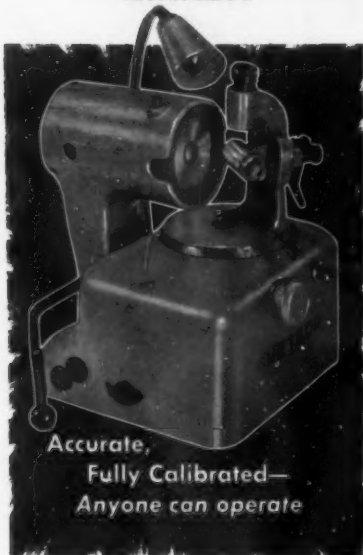
physically or when it can produce the product more economically.

The several processes still require a great amount of manual work. We must improve handling devices for tools and material. In addition, a whole new concept will be required in the design of quick opening dies. The design is made more difficult because of the high internal pressures acting upon the material and the dies. With diligent effort on the part of industry it is certain that the maximum utilization of high-energy rate in production will be made in the very near future. Through the application of these new processes we offer to the design engineers unfettered design freedom.

Based on SAE Paper No. 160C by E. W. Feddersen, Convair Div., General Dynamics Corp. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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Metal Fabrication by Explosives

The difference between conventional and explosive fabrication is the pressure-time work curve of the two methods. In explosive forming, the metal moves rapidly through its elastic range and into the plastic range, producing permanent set or shape within microseconds. It is in this phenomenon of high-rate stress-strain that the plasticity of metals behaves differently from that observed under conventional stress-strain conditions where initial stress loads are much lower.

A complete understanding of the action taking place in the metal under high stress-strain rates is not known. Atoms in a metal crystal are spaced at intervals and are held in position by the cohesive and repulsive forces acting between the atoms. It is these forces which are disturbed and rearranged under a stress which produces strain. This deformation is called "slip" and takes place along many planes in the crystal grain. It can be theorized that under high stress-strain rates associated with explosive forming, the atoms go through a series of slip, brake and heal events very rapidly. Ultimate failure occurs when the healing process or co-

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hesive forces between the atoms of the metal are insufficient to cope with the continued process of slipping. This occurs when the stress duration has been applied for too long a period. It is therefore necessary to control the duration of high stress application to prevent failure. Improper combinations of stress and strain can cause fracturing or shattering of the metals.

There is a band of high stress-strain combinations which can be used for the successful forming of metals by explosive forces. The main avenues of interest are sizing, forming, forging, welding, compaction, and conditioning. Other processes of minor interest are embossing, shearing, flanging, joggling, threading and extrusion.

Savings on over-all costs can be attained by the proper design-fabricating-tooling combinations just as metal parts are formed successfully by the proper explosive-technique-tooling combination.

Based on ASME Paper 60-MD-4, by Vasil Philipchuk, American Potash and Chemical Corp. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

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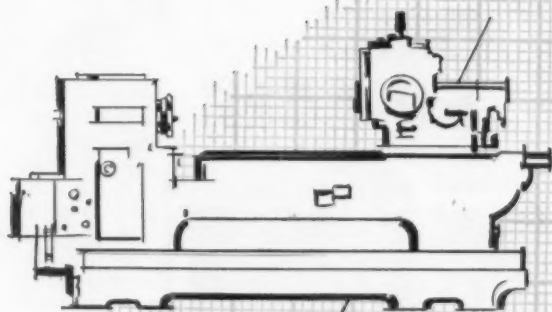
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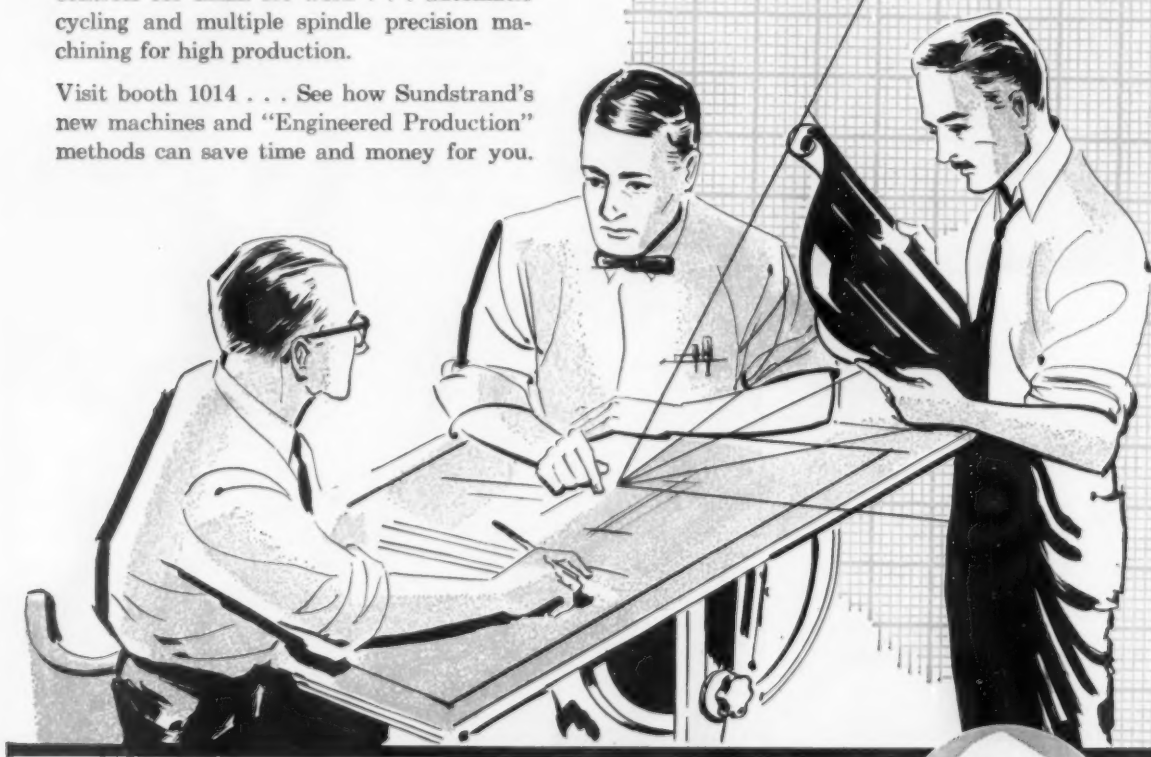
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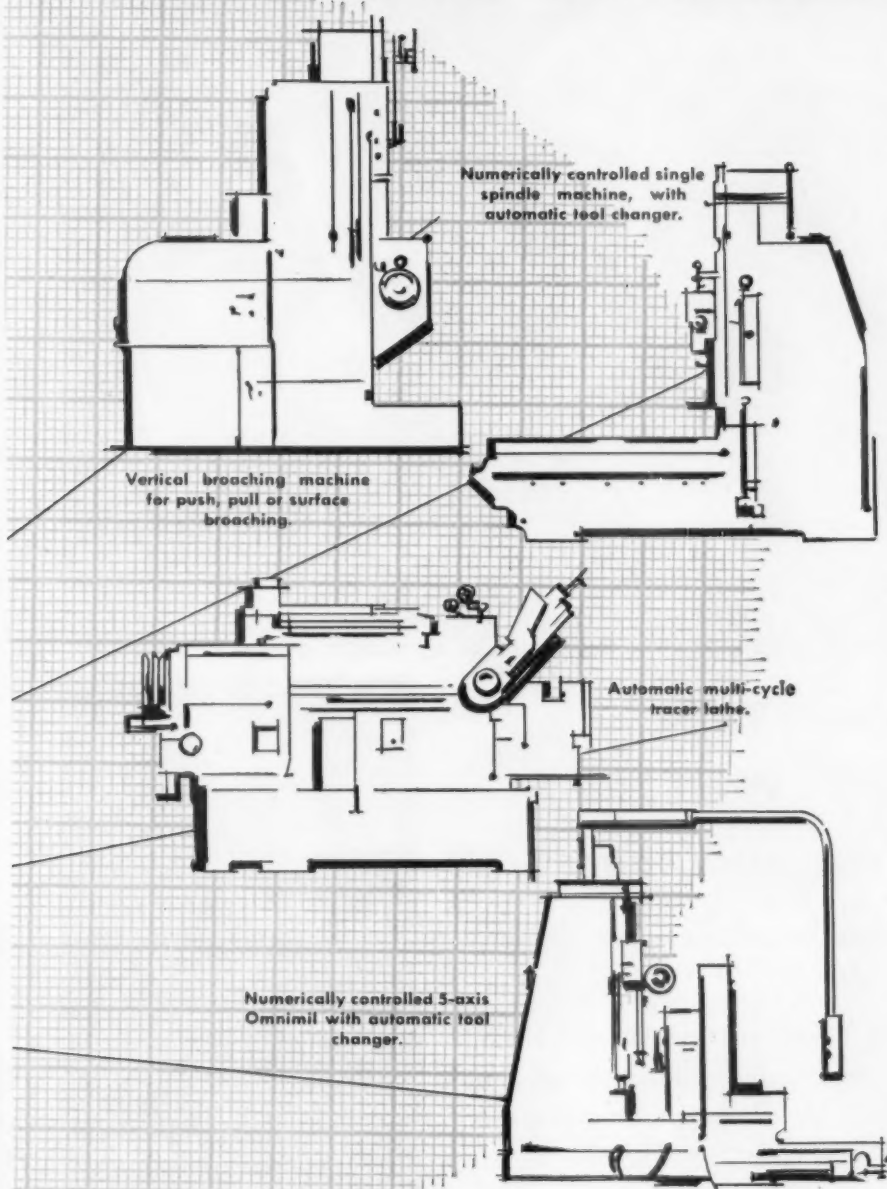


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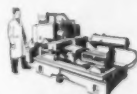
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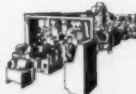
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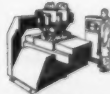
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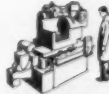
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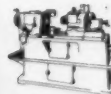
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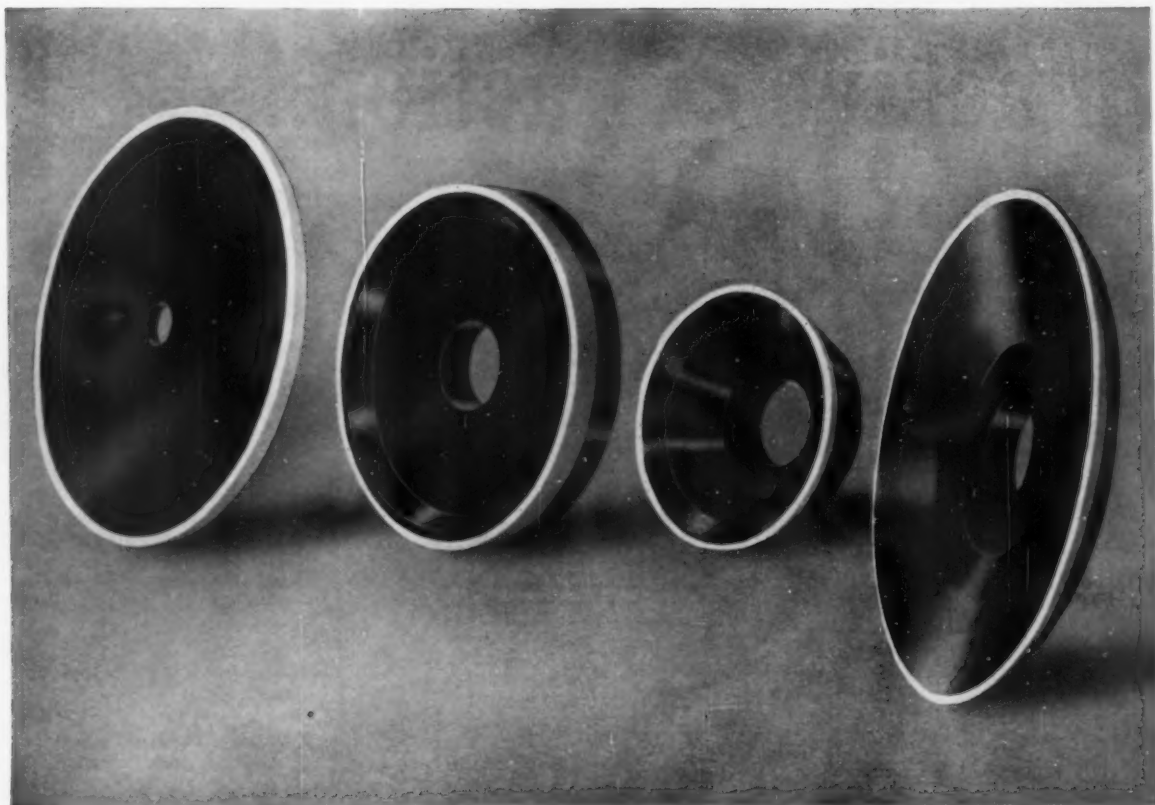
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Quick, jam-
free assembly and
disassembly, lasting accuracy,
unlimited selection of sizes and styles! Add to
these advantages the benefits of immediate service in every
industrial center through Producto's growing network of 46 branch
assembly plants and distributor warehouses...and you realize why "They all prefer
Producto". • **A WEALTH OF DIE SET INFORMATION** is available
to you, free, in the comprehensive, easy-to-use Producto
Catalog No. 11, and in regular issues of
Die Set Digest. Write today
for these valuable
aids.



THE PRODUCTO MACHINE COMPANY

925 Housatonic Avenue, Bridgeport 1, Connecticut

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

BURGMASTER

THE WORLD'S MOST COMPLETE LINE OF

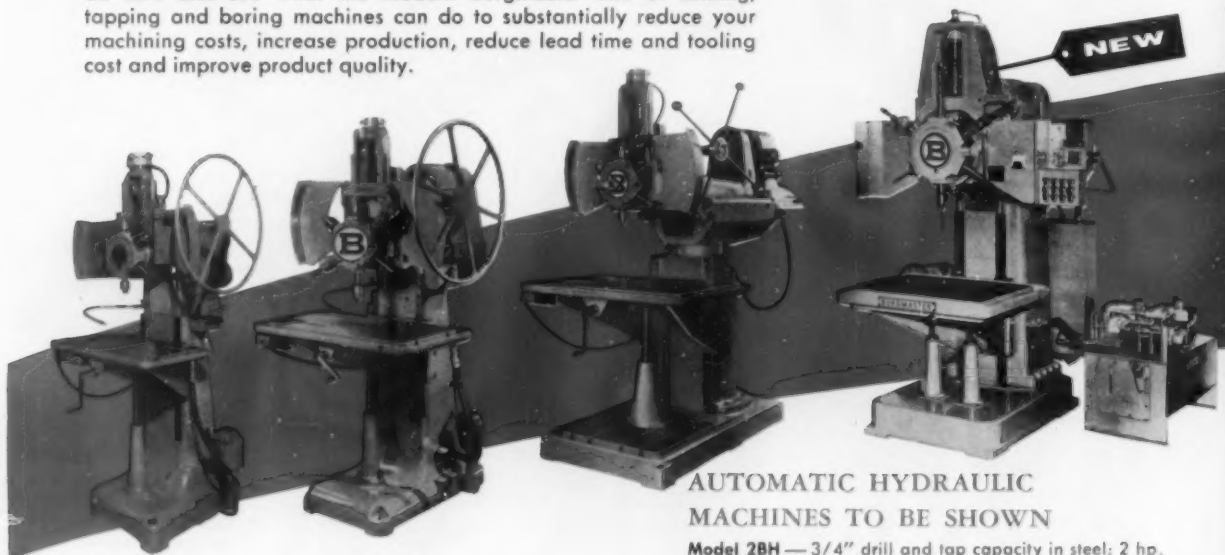
13 Burgmaster machine models will be shown at the Machine Tool Exposition. The many new developments in the Burgmaster line will be introduced by means of actual production demonstrations. Three entirely new Burgmaster models will be introduced and there will also be seven tape controlled Burgmaster machines in operation to show how you can reduce lead time from weeks to hours while increasing production by fully automatic machining.

Be sure and see what the modern Burgmaster line of drilling, tapping and boring machines can do to substantially reduce your machining costs, increase production, reduce lead time and tooling cost and improve product quality.

THE MACHINE TOOL



Exposition - 1960



HAND OPERATED MODELS TO BE SHOWN

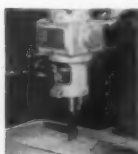
Model 1C—1/2" drill and tap capacity in cast iron; 1 hp.

Model 2B—3/4" drill and tap capacity in steel; 2 hp.

Model 2BR Radial—3/4" drill and tap capacity in steel; 2 hp.

HOW HAND OPERATED BURGMASTER TURRET DRILLS INCREASE PRODUCTION

Fast power turret indexing to perform a sequence of machining operations; Preselective spindle speeds—automatically changed for each spindle; Precision depth control; Quick setup—ideal for short run work.



See the new Burgmaster Lead Screw Tapping Head in action. This attachment greatly improves the accuracy and finish of tapped threads and eliminates scrap due to pulled or loose threads.

AUTOMATIC HYDRAULIC MACHINES TO BE SHOWN

Model 2BH—3/4" drill and tap capacity in steel; 2 hp.

Model 25AH—1-1/4" drill and tap capacity in steel; 7-1/2 hp.

Model 3BH—1-1/2" drill and tap capacity in steel; 10 hp.

AUTOMATIC HYDRAULIC MACHINE FEATURES SET THE PACE FOR FASTER PRODUCTION AND HIGHER QUALITY. Automatic operation determines the pace—one man can operate more than one machine with less effort and fatigue, while increasing production; Simple controls mean faster setups ideal for short run work; Pre-selective infinitely variable spindle feeds, pre-selective spindle speeds and pre-selective depth control.

NEW IMPROVED FEATURES

- Temperature and pressure compensated hydraulic feed—infinitely variable.
- Direct reading rate of feed indicator.
- 4-speed motor drive for wider speed range.
- Reciprocating feed for chip removal on deep hole drilling.
- Forged spindle with gear integral.
- "V" type automatic turret clamping ring.
- Quick-set depth stops.
- Improved lead screw tapping head.

PRESENTS.....

**TURRET DRILLING, TAPPING AND BORING MACHINES
SEE 7 TAPE CONTROLLED BURGMASER TURRET DRILLS AT
THE N-M-T-B EXPOSITION BOOTH 834**



TAPE CONTROLLED MACHINES TO BE SHOWN

Model 2BHT — 3/4" drill and tap capacity in steel; 2 hp; 10" x 18" positioning table; GE 2-axis tape control.

Model 2BHTL — 3/4" drill and tap capacity; 3 hp, 4-speed motor; 15" x 26" positioning table; GE 3-axis tape control.

Model 2BHTL — 3/4" drill and tap capacity; 3 hp, 4-speed motor; 15" x 26" positioning table; Hughes 3-axis tape control.

Model 25AHT — 1-1/4" drill and tap capacity in steel; 10 hp, 4-speed motor; 15" x 26" positioning table; GE 2-axis tape control.

Model 3BHT — 1-1/2" drill and tap capacity in steel; 15 hp, 4-speed motor; 20" x 30" positioning table; GE 2-axis tape control.

Model 3BHTL — 1-1/2" drill and tap capacity in steel; 15 hp, 4-speed motor; 30" x 45" positioning table; GE 2-axis tape control.

Model 3BHTB — double housing planer type; 1-1/2" drill and tap capacity in steel; 15 hp, 4-speed motor; 48" x 60" positioning table; GE 2-axis tape control.

WHAT BURGMASER TAPE CONTROL MEANS TO YOU

Greatly reduced lead time—get into production in a few hours; Eliminates complex fixtures or index devices. Drill jigs and bushings not required; Much less spoilage on difficult jobs— machine does not depend on operator's skill; Greater accuracy — holds hole location to .001", repeatable to .0005"; Easy to program — 1 minute per hole location; Prepare tape— 4 holes per minute; Set-up machine — 3-5 minutes per tool.



Write for Bulletin describing the complete line of Burgmaster 6 and 8- Spindle Turret Drilling, Tapping and Boring Machines. Forty minute 16 mm sound film showing all Burgmaster Turret Drills in operation is available without charge.

BURG TOOL

MANUFACTURING COMPANY, INC.
15001 South Figueroa St., Gardena, Calif.
FACULTY 1-3510 • DAVIS 9-4158

BURGMASER DIRECT SALES OFFICES: Ridgewood, N.J., 86 North Maple Ave., Gilbert 4-3002 • Chicago 5, Ill., 4908 Lincoln Ave., Long Beach 1-1178 • Cleveland 7, Ohio, 14706 Detroit Ave., ACademy 6-7030 • Detroit 37, Mich., 13730 W. Eight Mile Rd., Lincoln 8-4333 • San Francisco, Calif.

Plus dealer representatives in other industrial centers.





Precision Ground

**SOLID CARBIDE
TOOLS AND BURS**

Job Applications

THERE IS AN ATRAX SOLID CARBIDE END MILL ENGINEERED FOR SUPERIOR CUTTING PERFORMANCE ON ANY MATERIAL!

RECOMMENDED APPLICATIONS ATRAX "STANDARD" SOLID CARBIDE END MILLS

202 different "standard" Atrax Solid Carbide End Mills in 20 different series, each engineered for a specific cutting application and recommended for specific materials.

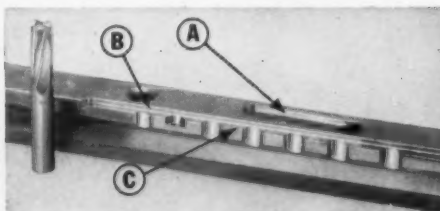
The most widely used Atrax End Mills and the materials on which they are engineered to perform best are shown in this table:



Material	Series 1501	Series 1502	Series 1503	Series 1504	Series 1505
Carbon Steels					X
Free Cutting Steels					X
Nickel					X
Nickel Chrome					X
Stainless Steels					X
Cast Iron		X	X		
Malleable Iron		X	X		X
Brass and Bronze	X				
Aluminum	X			X	
Zinc Alloy	X				
Copper	X				
Hard Rubber	X				
Fibre	X				
Plastics	X				
Monel Metal					X
Toughened & Heat Treated Steel					X
Hardened Steels					X
Titanium					X
Magnesium	X			X	

X—Preferences

TYPICAL SERIES 1505 PERFORMANCE ON ROCKWELL C-64 HARDENED TOOL STEEL WORKPIECE



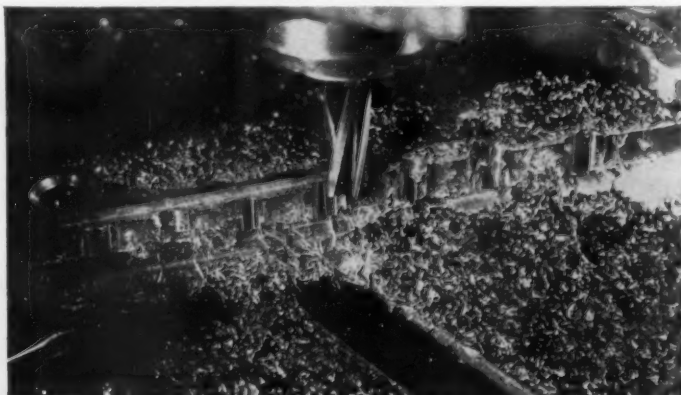
A Elongating $\frac{3}{8}$ " slot, $\frac{1}{16}$ " deep at 700 rpm.

B Step cutting $\frac{3}{16}$ " wide— $\frac{3}{32}$ " deep at 1150 rpm.

C Counter boring at 1150 rpm.

Note high surface finish and absence of burs and scoring. This Atrax $\frac{3}{8}$ " 1505 End Mill showed no appreci-

able wear land after completing three operations on this hard-to-cut material.



Note efficient, uniform chips with no burning and no chatter.

AN END MILL FOR EVERY APPLICATION

There is an Atrax "Standard" Solid Carbide End Mill job engineered for virtually every End Milling application. The Atrax Catalog gives engineering data on speeds, feeds, use of coolants and job hints that will further increase tool life production when you specify and use these superior Atrax Tools.

Send for your copy of the 148 page Atrax Catalog

THE ATRAX COMPANY

240 DAY STREET, NEWINGTON 11, CONNECTICUT



ANOTHER **NORTON** PRODUCT

the New **VIZI-DISC**

*lets you see
your work while
you grind. It cuts
cooler and gives you
pin-point accuracy*

The unique shape of the METALITE VIZI-DISC gives it "see-through" like a fan blade or an airplane propeller. The operator can see right through the work area of the disc. Obviously, the intermittent action means cooler operation. Get a free demonstration of VIZI-DISC. Just call your Behr-Manning representative or write Dept. TE-9, BEHR-MANNING CO., TROY, N. Y., A DIVISION OF NORTON COMPANY.



Coated Abrasives



Here is the VIZI-DISC mounted on a portable electric grinder, ready to run. Note the unique shape with parallel sides.



As the grinder starts, note the spinning pattern, similar to an airplane propeller or the blade of an electric fan.



Full rpm. With the VIZI-DISC there is no blind spot. You see your work while you work, as the grinder gets revved up.



One of a series

The Case for the Terrestrial Traveler

Figure that every thirteen seconds American drivers motor 238,000 miles — the distance to the moon. Increasing the efficiency, comfort, and safety of this incredible private transportation system (60 million cars!) is a top project goal of the General Motors Research Laboratories. From this sizable R & D program have already come a number of experimental controls and driver aids now being evaluated in the field.

New ways of supplying drivers with traffic and road information — electronic edge-of-road detectors; communication systems for giving drivers audible road and emergency information.

Simplified driver controls — Unicontrol, a servo system in which the driver steers, accelerates, and brakes his car with a single control stick.

Tested methods of automatic vehicle control — refined computers and electro-hydraulic servomechanisms that automatically guide cars and control their speed and spacing.

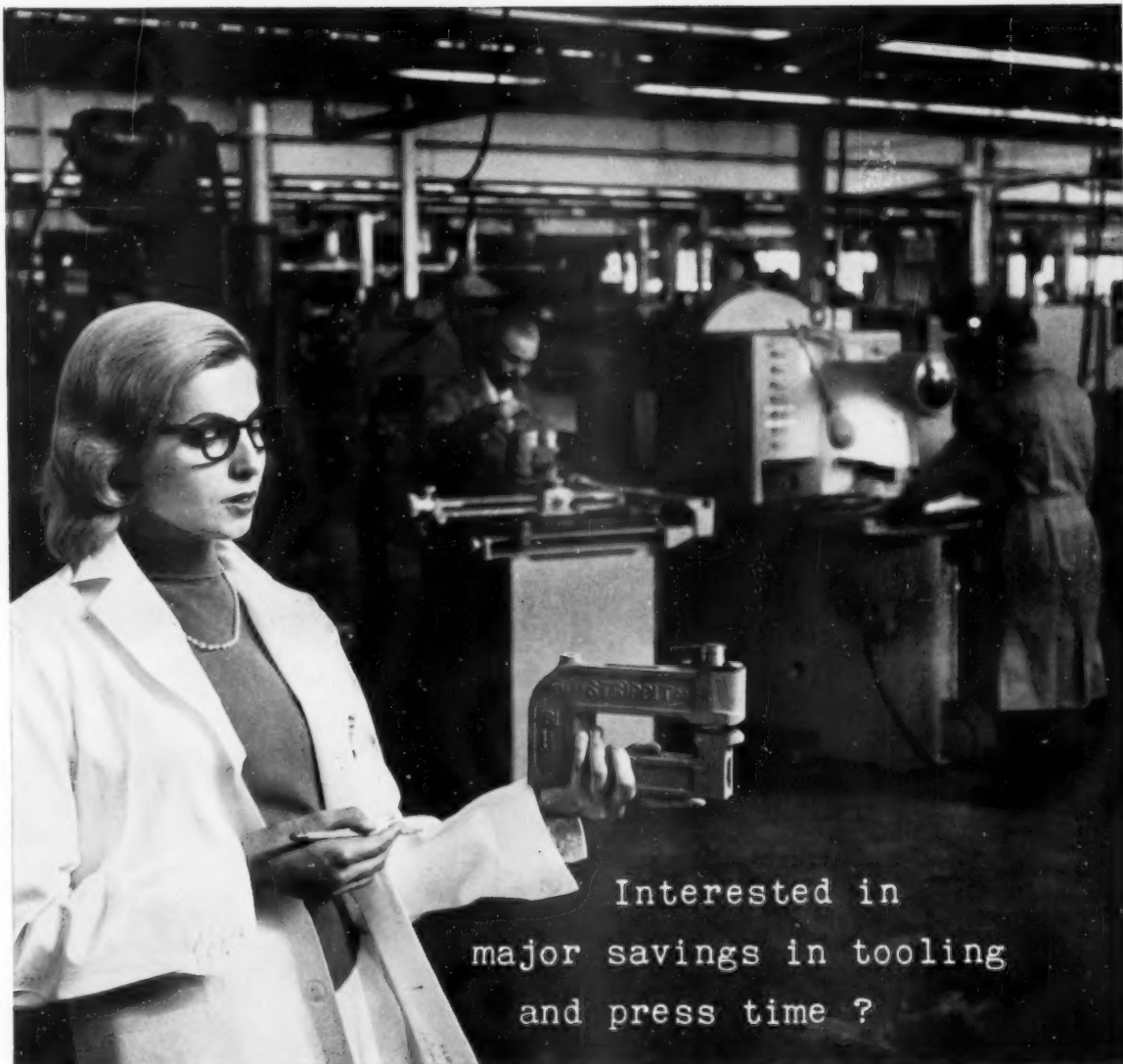
Underlying these developments are a continuing series of fundamental studies. In vehicle dynamics research: investigations of the effect of tire properties, suspension geometry, mass distribution, springs and dampers on the ride and handling characteristics of cars. In human factors research: experiments to determine the perception and response of drivers to various traffic situations using different car control systems.

At GM Research, we believe such fresh approaches will improve car-driver compatibility, providing additional convenience and enjoyment for tomorrow's terrestrial traveler.

General Motors Research Laboratories
Warren, Michigan

Car pickup coils and road wiring
used for guidance and speed control
in one experimental automatic
highway system under study.

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Interested in
major savings in tooling
and press time ?

Come to STRIPPIT - Booth 340 at Chicago's Navy Pier

You'll get a fresh slant on ways to work metal when you visit the Production Engineering Show in September. Stop by the STRIPPIT booth and see how our self-contained punching units eliminate expensive dies, how the Flex-O-Drill sharply reduces template making time, how our versatile Fabricators simplify pilot and production runs. SELF-CONTAINED HOLE PUNCHING UNITS reduce tooling to a simple assembly operation. Punches, stripping guides and die buttons are component parts of the unit. Nothing's attached to press ram. No die set required!

STRIPPIT FLEX-O-DRILL (left) speeds production of accurate templates and layouts. A table-top precision machine for drilling, reaming, center punching and scribing, Flex-O-Drill does away with need for base-line drawings or vernier height gauges. Handles $\frac{1}{4}$ " material up to 24" wide and in any length. STRIPPIT MODEL

15A FABRICATOR (right), the latest model of one of industry's most versatile sheet metalworking machines, features the new Strippit Electro-Hydraulic Head for controlling the stroke. The time-saving Fabricator punches any sheet material up to $\frac{1}{4}$ " thick, notches and nibbles up to $\frac{1}{8}$ " thick material.

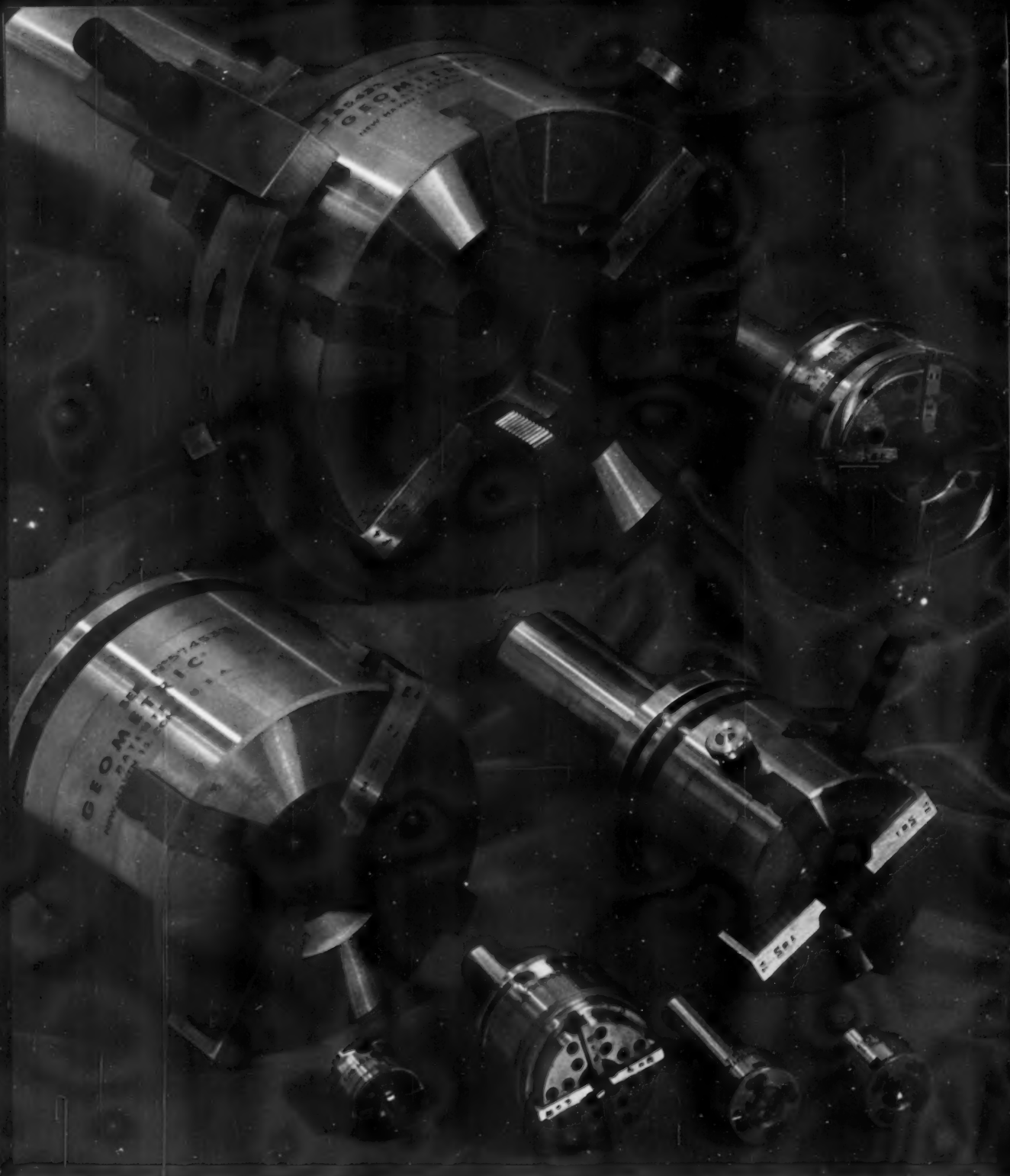
If you can't make the show, be sure to write for the General Catalog explaining the STRIPPIT System.



WALES STRIPPIT INC.

211 Buell Road Akron, New York

*In Canada: Strippit Tool & Machine Company, Brampton, Ontario;
In Continental Europe: Raskin, S.A., Lausanne, Switzerland; In the
British Isles: E.H. Jones, (Machine Tools) Ltd., Hove, Sussex, England.*



**All
these
... and
many
more**

Whether your threading requirements cover miniature or very large tools, average or extremely close tolerances, run of the mill or space age components, short runs or long repetitive runs, somewhere in the GEOMETRIC line there is a tool for the job.

Precision operation, simplicity of design, interchangeability of chasers, high quality of materials and workmanship have made the name GEOMETRIC mean superlative tools.

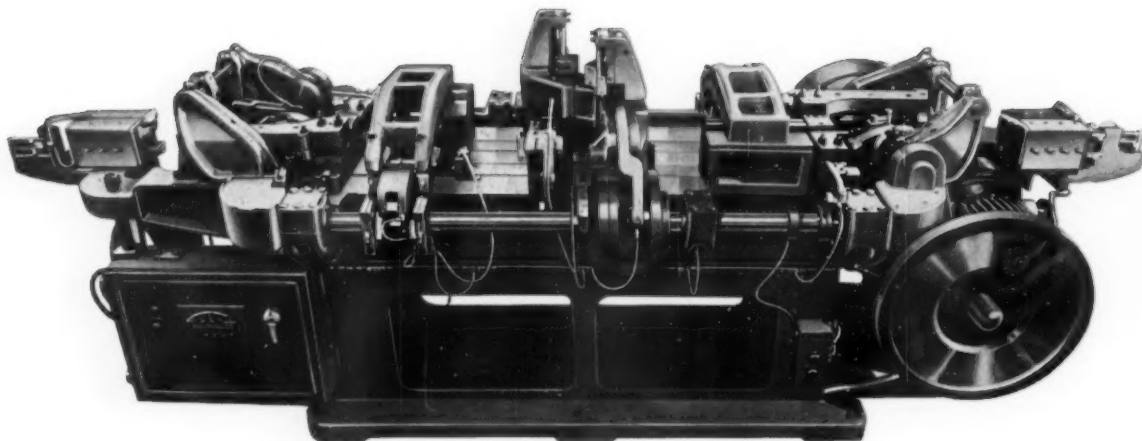


If you are not at present a user of GEOMETRICS, we invite your inquiries. If you are a user, we suggest further investigation of the broad line for other applications.

For more information on the COMPLETE GEOMETRIC line, including range of sizes, special adaptations and styles not shown above, call your local GEOMETRIC Distributor, or write to

GEOMETRIC-HORTON NEW HAVEN 15, CONNECTICUT
Visit Booth 345 National Machine Tool Show





U.S. DUPLEX MULTI-SLIDE® **SIMULTANEOUSLY** **FEEDS AT BOTH ENDS** **& PRODUCES TWO OR** **MORE STAMPINGS &** **FORMS & ASSEMBLES**

The new U. S. Duplex Multi-Slide is a double ended machine which more than doubles previous production potentials.

With the U. S. Duplex you can ■ Produce and assemble 2 different stampings from the same or dissimilar materials. ■ Produce and assemble 2 complementary stampings. ■ Produce stampings from one end, wire form from the other end and assemble. ■ Produce 2 stampings and assemble with hopper-fed, pre-fabricated parts. ■ Make 3 piece assemblies, feeding material from both ends — and from the top. ■ Make 2 or more identical or different stampings not requiring assembly — and of the same or different material. ■ And, can be operated as a conventional Multi-Slide by feeding material into one end only. Standard U. S. Duplex Multi-Slide equipment includes a feed, stock straightener, check and ram action at each end and a common 4-slide forming position with double, vertical strippers at the center. Material up to 3" wide can be fed into both ends of machine simultaneously. Feed length is adjustable up to a maximum of 6" and can differ from each end of the machine. Investigate the economies a U. S. Duplex Multi-Slide can give you. A few of these are: elimination of secondary operations; savings in floor space; ease of inspection of finished assemblies; and fewer rejects . . . all through the versatility of the "Duplex".

Write today for full information and specifications. Send us your samples or drawings today and let us show you.

See the U. S. Duplex Multi-Slide in Booth No. 842 at the 1960 Machine Tool Exposition.



U.S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY

U. S. Multi-Slide® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

Use Reader Service Card, CIRCLE 156

Use Reader Service Card, CIRCLE 157

The Tool and Manufacturing Engineer

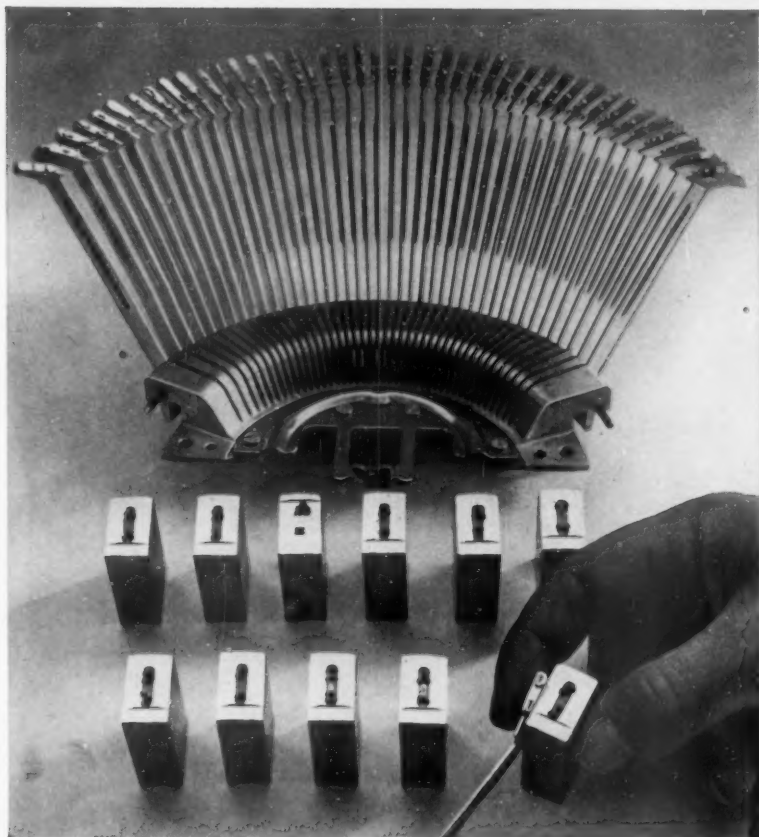


Tool Steel Topics



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Formerly The Bethlehem Steel Tool Steel Company



IBM makes 200 per cent more type slugs per matrix with Bearcat Tool Steel

Talk about enthusiasm! At the Lexington, Ky., plant of International Business Machines Corp. they have good reason to sing the praises of Bearcat tool steel. Recently, production of type slugs per matrix was improved 200 per cent by changing to a die made of Bearcat. The die "kneads" raised letters of the alphabet into steel slugs.

Bearcat is best known for its remarkable shock-resistance. In this instance, the manufacturer also reported better

resistance to wear, and easier machinability (as compared with the tool steel formerly used).

Bearcat is our super grade of shock-resistant air-hardening tool steel. It's ready and willing to handle the toughest shock applications. Because it's an air-hardening steel, Bearcat minimizes both quenching hazards and distortion in heat-treatment.

Like to try Bearcat? Telephone your Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL



ENGINEER SAYS:

TOOLS can be repaired by welding if the proper procedure is used

To incorporate design changes or repair, all tools and dies made of tool steel can be welded successfully if the following procedure is observed:

1. Full-anneal the tools. Good atmosphere control is necessary to avoid scaling and decarburization of the working surfaces.
2. Prepare the crack for welding by "veeing" its full depth and length. Magnetic particle inspection is advisable.
3. Use a welding rod which will deposit steel of the same composition as the tool.
4. Preheat to 400 F - 800 F, and maintain this temperature during welding.
5. Clean the slag from each bead before proceeding with the next bead.
6. Immediately after welding, transfer the tool into a warm furnace (400 F min) and full-anneal.
7. Machine or grind the weld to the desired tool dimensions.
8. Heat-treat the tool by quenching and tempering to the desired hardness, using the standard procedure for the grade involved.
9. Grind the tool working surfaces. The depth of metal removal will depend upon the amount of decarburization produced in Steps 1, 6, and 8.

The use of this procedure will permit the successful welding of tools if it is essential that welding be done. In the majority of instances, however, it will be found both cheaper and quicker to make up new tools.

When emergency welding is done on a production line, it is often necessary to eliminate many of the steps mentioned above, thereby reducing the chances of producing successful welds.

Use Reader Service Card, CIRCLE 158

No other tracer attachment has all these features

Traces from any template (round, flat, wood, metal) or standard product.

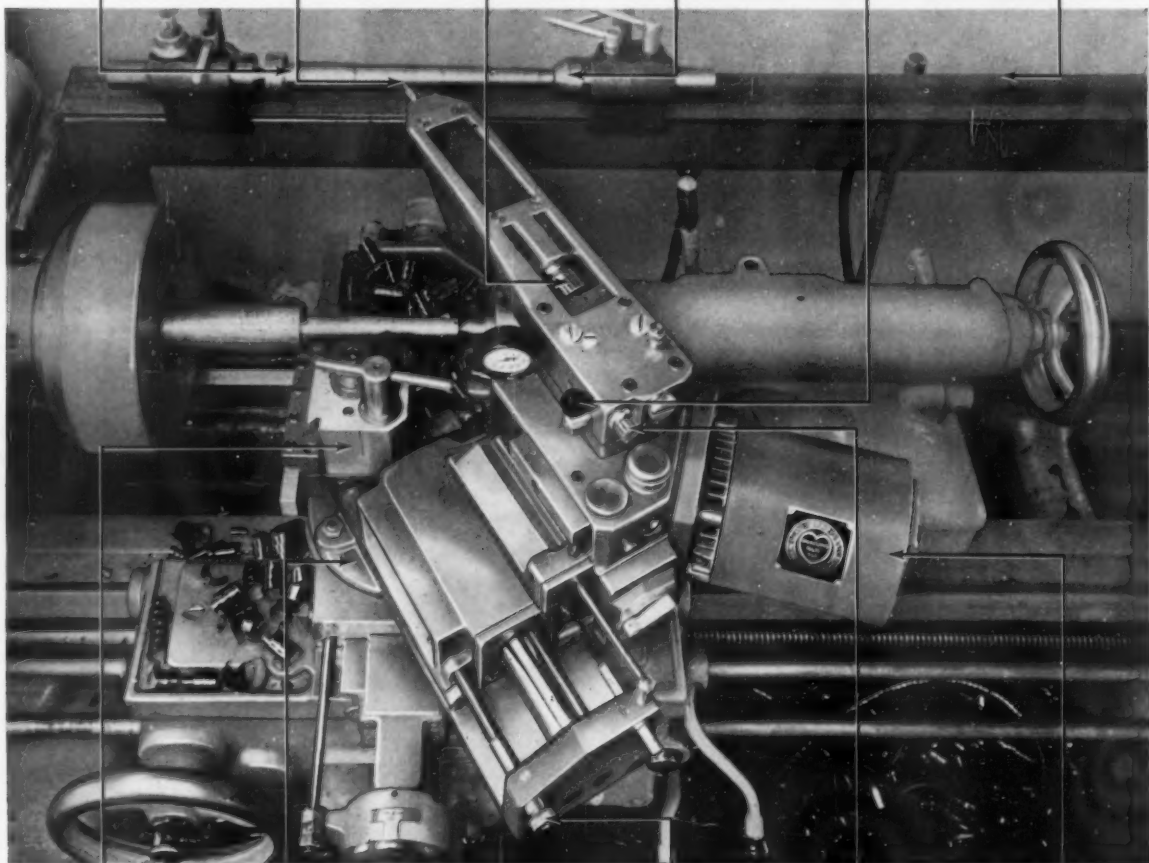
Tracer controls tool in continuous path for smooth, accurate finish.

Micrometer adjusts for cutting over, under or exact size.

Adjustable eccentric on template protects lathe tailstock.

Easy-to-reach control knob initiates or interrupts cycle.

Template rails furnished any length and with brackets to fit any lathe.



Tool post and holders designed for quick change of pre-set tools.

Complete swiveling for turning, boring or internal cutting at any angle.

Does not limit utility of lathe . . . regular turning can be done with tracer installed.

Positive stop locks unit for non-tracing cuts.

Adjustable valve controls feed rate for non-tracing work.

Close-coupled motor and pump eliminates hoses, assures sensitive control.

For far less than you would imagine, you can quickly convert any good lathe for turning multiple diameter shafts or for turning, facing and boring contoured workpieces . . . single pieces or high production. Three sizes to fit any lathe up to 27½" swing and up to 30 horsepower.

Write for complete information.



LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS

HYDRAULIC LATHE TRACER ATTACHMENT

Visit Leland-Gifford BOOTH 631

MACHINE TOOL EXPOSITION





From right to left: Bob Muenz, O. A. Muenz Co., Newark, N. J., SPEEDICUT Distributors; George Malmgren, Engineer, Federal Boiler, Midland Park, N. J.; Hank Collins, SPEEDICUT Service Engineer. Machine operator, Dave Hand.

SPEEDICUT "CHIPBREAKER" slashes 8-hour drilling job to 3 hours for Federal Boiler Company!

Using the best conventional drills available, it used to take Federal Boiler a full eight hours to drill a pattern of 60 holes, $3\frac{1}{32}$ " diameter, in an 8-inch stack of $\frac{3}{8}$ " boiler plate. And tool life never exceeded 40 holes per grind. Now—with a SPEEDICUT "CHIPBREAKER"—the same job takes just three hours, tool life has zoomed to 75 holes per grind, and an extreme chip condition has been eliminated. And the SPEEDICUT "CHIPBREAKER" costs no more than conventional drills! Such spectacular time and cost-cutting records are the rule (not the exception) with SPEEDICUT "CHIPBREAKER". This unique tool, with the patented rib*, permits 50% to 400% higher feed rates, uninterrupted deep hole drilling and more holes per grind in any machinable material. If drilling holes is a part of your operations, it will pay you to see the SPEEDICUT "CHIPBREAKER" demonstrated in your own plant on your equipment and type of work. Write today for descriptive brochure and name of your local authorized distributor.



THE PATENTED RIB
that cannot be duplicated

*U.S. Patent Number 2768365

SPEEDICUT DIVISION, CHICAGO HEIGHTS STEEL CO., CHICAGO HEIGHTS, ILL.

Adamas Carbide's Record at Ford

...proves it pays to select by performance!

ADAMAS JOB REPORT FOR:

Ford Motor Company

PLANT: Sterling Plant, Warren, Mich.

PART(S): Ford Rear Axle Shafts—No. 4235

MATERIAL: SAE-1038 Steel Forging, Brinell 179-229

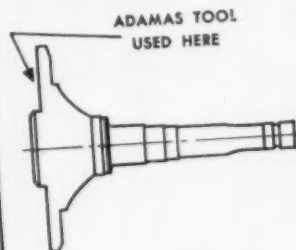
MACHINE: Snyder Lathe

OPERATION: Flange Facing—6.47 flange OD to 2.46
pilot diam. ... 930 to 360 sfpm. ...
feed .016 ... depth of cut .030 to .090
variable

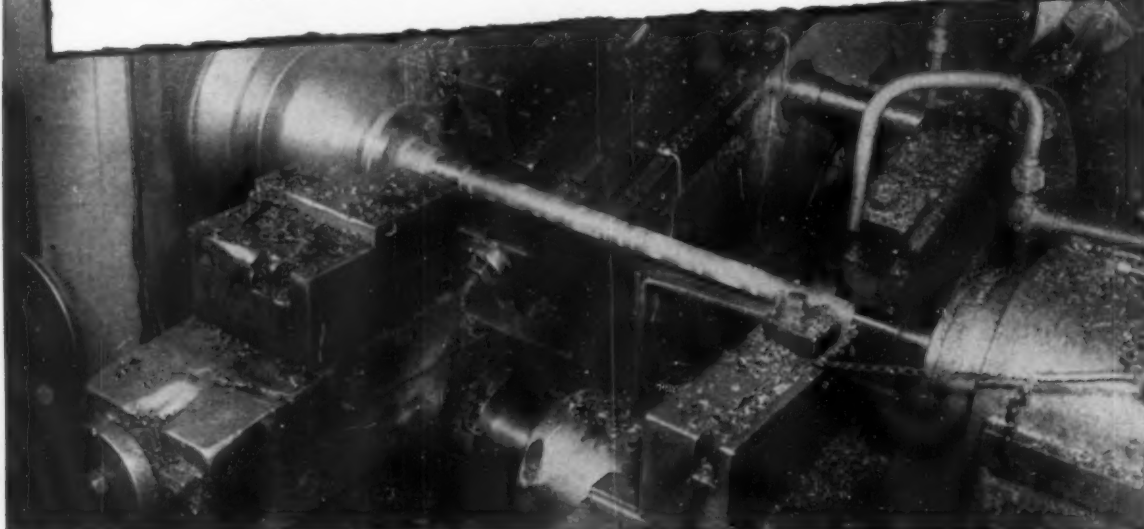
ADAMAS RECOMMENDATION: Grade 548

PERFORMANCE: With Grade 548 inserts, Ford gets more
pieces per grind—uses Adamas as an
approved supplier on this operation.

OPERATIONAL DIAGRAM



John Grey
7/1/54



■ The ability of Adamas Grade 548 to face flanges on more rear axle shafts, at minimized tool grinds, has greatly assisted in enabling Ford to substantially increase production. It has also played a part in Ford's obtaining lower tool costs ... longer tool life ... less machine downtime ... faster feeds ... variable speeds ... virtual elimination of rejects.

■ Grade 548's record 6-year run at Ford: optimum capability for consistent high performance and profitable volume production ... Another outstanding example of what is being accomplished by Adamas in plants of all sizes throughout the country.

■ Adamas produces standard and special tungsten carbide products for every metalworking application. For details on Adamas Performance-Proved carbide products best suited to your requirements contact your nearest Adamas representative or write direct.

FREE: Ask for your copy of NEW ADAMAS PRICE LIST No. PL-960.

Producers of
Tungsten Carbide Tools,
Tool Tips,
Dies, Wear Parts,
Dex-A-Tool,
Dex-A-Mill



ADAMAS CARBIDE CORPORATION
KENILWORTH, NEW JERSEY

PROGRESSIVE CARBIDE USERS SELECT BY Performance...NOT HABIT!

See ADAMAS at BOOTH #153—Production Engineering Show—Chicago Navy Pier

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The Tool and Manufacturing Engineer

NEW

A NEW **Starrett**
BAND SAW BLADE

ALLOY BAND

Cuts 50% Faster
with up to
50% Lower Cut-Off Costs



HERE'S HOW
Starrett ALLOY BAND
CUTS CUT-OFF COSTS 50%

- Up to 50% faster cutting speed.
- Greater blade life with less blade changing and reduced down time.
- Makes standard band saw machines operate at close to maximum efficiency.
- Cuts a wider range of metals including many tough alloy steels.
- Improved hot hardness and abrasion resistance permits faster speeds, heavier feeds.
- Eliminates investment in expensive, special equipment.

Starrett ALLOY BAND is a new double carbide special alloy band saw blade developed for one purpose only — *faster, more economical cutting and greatly extended cutting capability from standard band saw machines.*

Improved hot hardness and abrasion resistance permits higher speeds and heavier feeds on standard machines . . . extends the range of materials that can be cut including many of the tougher alloy steels . . . gives greater blade life with less blade changing and reduced down time.

Standard band saw machines can be operated at close to maximum efficiency with Starrett ALLOY BAND . . . saving up to 50% in cut-off costs and eliminating the need for expensive, special equipment.

Starrett ALLOY BAND can be used in many cases on high speed band saw machines for which we also recommend Starrett Safe-Flex® High Speed Steel Band Saw Blades.

For complete information on the new Starrett ALLOY BAND, see your Starrett Industrial Supply Distributor — or write Dept. E, The L. S. Starrett Company, Athol, Massachusetts, U.S.A.

World's Greatest Toolmakers

Starrett ALLOY BAND

VISIT THE STARRETT EXHIBIT • BOOTHS 150-152 • PRODUCTION ENGINEERING SHOW

The Most Comprehensive Gear Service ever offered!

Sier-Bath's Tri-Dimensional Gear Service

**1.
FREE
DESIGN
ENGINEERING
CONSULTATION**

GEAR RANGE and SERVICES

Bevel Gears, Straight and Coniflex,
2" to 24" O.D., depending on ratio,
3 to 32 Pitch.

Miter Gears, 2" to 17" O.D., 3 to 32 P.

Spur Gears, 2" to 48" O.D., 3 to 48 P.

Helical Gears, 2" to 48" O.D., 3 to 48 P.

Ground and Crown-Ground Helical and
Spur Gears to 12" O.D., 4 to 48 P.

Other Ground Tooth Spur Gears to 17"
O.D., 4 to 16 P.

Worm Gears, 2" to 48" O.D., 3 to 32 P.

Worms to 12" O.D. by 36" long.

Ground Thread Worms to 6" O.D.

Herringbone Gears, to 36" O.D., 3
to 24 P.

Instrument Gears, 1" dia. up, to 48 P.

Internal Gears, 2" to 36" O.D., 4 to
48 P.

Involute and Square Splines, ground
and unground to 16" O.D. by 36"
long.

Shafts, splined and pinioned to 60"
long.

Internal Helical Broaching to 24"

Diameter of Blank.

Precision Hobbing, Shaving, Grinding
of all materials.

Gear Boxes custom designed and mfd.

**2.
GEARS
GUARANTEED
TO MEET YOUR
REQUIREMENTS**

**3.
IMMEDIATE
and ANALYTICAL
FIELD SERVICE**
(Before and after
installation)

**—All for the price
of the Prototype
and/or Production Order**

Your first bonus from Sier-Bath's Tri-Dimensional Service is free consultation with our gear design engineering staff of incomparable ability developed through designing unending thousands of advanced design successes. Your gears and gear units are designed to the most advanced principles of "gearometry," to assure the *ONE best gear design for your particular application the first time around.*

Your second bonus is the infallibly accurate—and economical—production of your gears and gear units by Sier-Bath's skilled gear craftsmen, working with the most advanced, automatic, high-speed production equipment and the most ex-

tensive gear testing equipment ever assembled under one roof. Sier-Bath precision gears provide master gear benefits at a fraction of the price.

Your third bonus is the use of our gear experts at your plant or in the field, before and after installation, to assure the advantageous performance and saleability of your units.

Make Sier-Bath your "gear department" for complete service including design, engineering, tooling, production, inspection and dependable field service. You'll save engineering time, get better gears at lower cost and give your machines utmost productive capacity and trouble-free operation.

Send your gear drawings—or request one of our engineers to discuss your gear applications. Write for comprehensive Gear Manual on your company letterhead.

Sier-Bath GEAR and PUMP CO., Inc., 9205 Hudson Blvd., North Bergen, N. J.

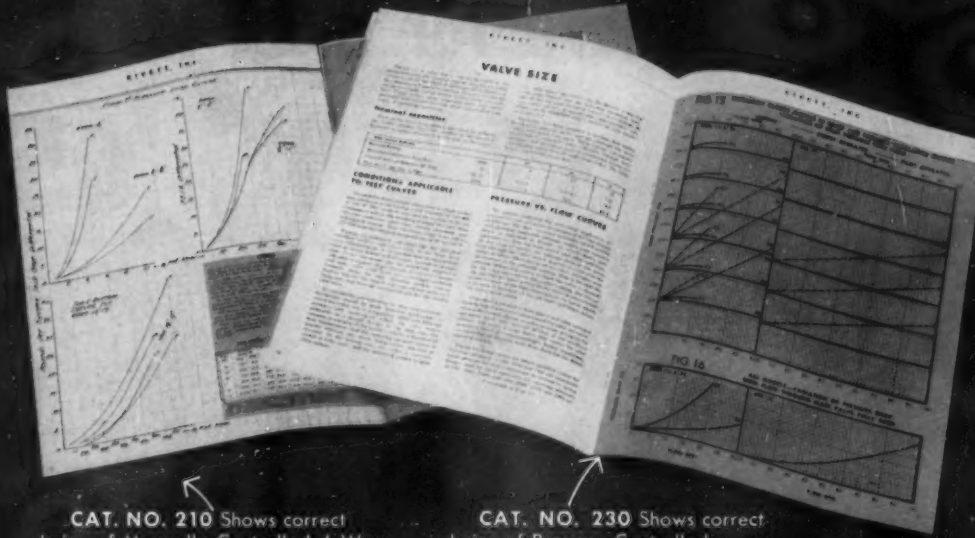


Founded 1905 Members A.G.M.A.

Also manufacturers of Rotary
Pumps and Flexible Gear Couplings

**Sier-Bath
PRECISION
GEARS**

STOP GUESSING VALVE PERFORMANCE!



CAT. NO. 210 Shows correct choice of Manually Controlled 4-Way Hydraulic Valves

CAT. NO. 230 Shows correct choice of Pressure Controlled Hydraulic Valves

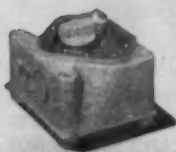
RIVETT Publishes The Facts So You Can Predict Accurately Pressure Drop In 4-Way and Pressure Controlled Hydraulic Valves!

Select your valves on facts, not guesses! The flow versus pressure drop curves shown in the catalogs above are based on actual tests. The curves make it

possible to determine system efficiency and operating costs *before* you operate the circuit. Rivett's lower pressure drop means a lower cost to actually run your hydraulic systems. Before you specify the components for your next system, get the facts! Ask your Rivett dealer, or write for Rivett Catalogs 210, 230, 250 and 261 now.

RIVETT

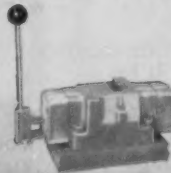
Furnishes Complete Line of Hydraulic Valves — Over 400 Standard Models — 1500, 2000, 3000 P.S.I.—Sub-Plate and Pipe Mounted— $\frac{1}{4}$ " to $1\frac{1}{2}$ " Sizes—3 G.P.M. to 130 G.P.M.



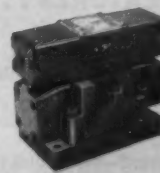
FLOW CONTROL
Model 8622; 3000 P.S.I.; Sub-Plate Mounted. Four Sizes: $\frac{1}{4}$ " to $1\frac{1}{2}$ ". See Catalog 250.



PRESSURE CONTROL
Series 8800: Relief, Sequence, Unloading, Reducing, and Counter-balance. With and without check. See Catalog 230.



MANUAL CONTROL
Series 5000 and 6100; 4-Way, Hand, Foot, or Cam, Sub-plate or Pipe Mounted. $\frac{1}{4}$ " to 2" sizes. 2000 and 3000 P.S.I. See Catalog 210.



SOLENOID CONTROL
Series 6500 and 6600; 4-Way, Direct or Pilot operated. $\frac{1}{4}$ " to $1\frac{1}{2}$ " in three basic sizes. 3000 P.S.I. Low current. See Catalog 261.



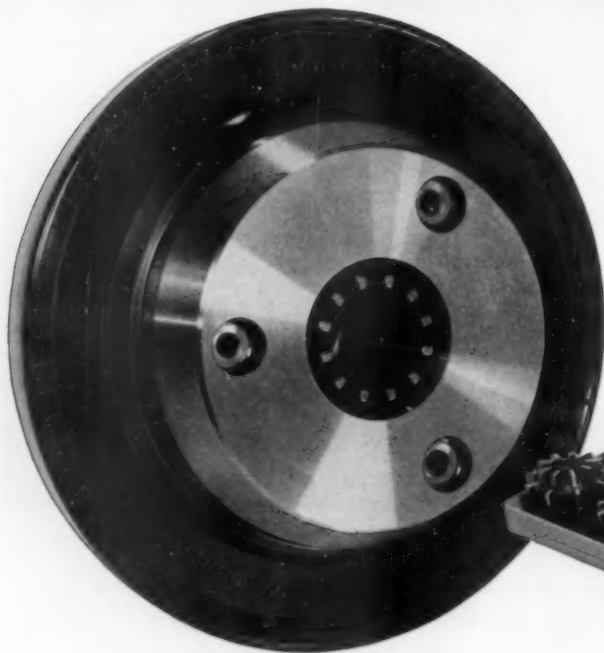
PILOT CONTROL
Available in Solenoid, Pressure and Manual operations. $\frac{1}{4}$ " to $1\frac{1}{2}$ " sizes. 1500, 2000 and 3000 P.S.I.

RIVETT

RIVETT, Dept. TE-9 Brighton 35, Boston, Mass.
furnishes a complete power package

AIR AND HYDRAULIC — VALVES, CYLINDERS, POWER UNITS
Member — National Fluid Power Association

New MODEL 50 equips your lathes to do a lot more for a lot less!



\$70⁰⁰
for the chuck

\$65⁰⁰
for the collets



THE WORLD'S MOST MODERN COLLET CHUCK

Designed expressly for ATLAS, CLAUSING, DELTA, LOGAN, SHELDON, and SOUTH BEND LATHES

These and others of similar power and capacity now give top performance when equipped with the new Jacobs Model 50. Improve performance of your lathes. Increase spindle capacity as much as 42%. Get greater accuracy and stronger grip. It's easy and inexpensive with new Model 50 and its companion Rubber-Flex collets.

CONSIDER THESE FEATURES . . .

● Gripping Power

Model 50 is made for heavy duty turning. It has tremendous gripping power.

● Accuracy

Model 50 is factory tested—maximum runout .001" T.I.R. at the nose when properly mounted.

● Thin Walled and Fragile Work

Always parallel Model 50 Rubber-Flex collet jaws permit chucking of tubing and fragile materials without crimping or scoring.

● Range

The 10 Rubber-Flex collets in the 500 Series, developed especially for use with Model 50, cover a greater bar stock range than 63 old-fashioned steel collets. You can chuck any bar between 3/32" and 1-1/16" with this set of 10 collets.

● Capacity

Model 50 eliminates capacity-wasting draw bar. You can increase spindle capacity up to 42%.

● Adapters

Model 50 adapters are fully machined for immediate mounting. Available in all popular threads and American Standard L00 taper.

● Price

Model 50 prices are revolutionary!

\$70.00 for the chuck.

\$65.00 for the complete set of 10 collets.

MODERNIZE YOUR LATHES WITH JACOBS MODEL 50 AND RUBBER-FLEX COLLETS. YOU CAN'T AFFORD NOT TO!

See your Jacobs industrial supply distributor. Give him the opportunity to prove these fantastic facts with a convincing demonstration at your desk! Call him today.



Jacobs
CHUCKS

The Jacobs Manufacturing Co., West Hartford 10, Conn.

The Tool and Manufacturing Engineer

TOOLING IDEAS FOR RECESSING

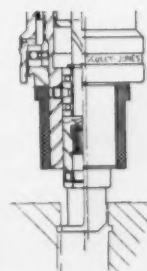


Building-block design principle used in Scully-Jones new automatic recessing tools **increases work range** of each tool, reduces inventories and tooling costs. For use in drill presses, radial drills, and special machines, these new tools cover a range of work hole diameters from $\frac{1}{4}$ " to $4\frac{1}{2}$ " and depth of cut to .300". Four sizes are available with interchangeable stop collars and pilot nose assemblies for piloting either in fixture bushings or in the work. Three sizes are provided for piloting in the work only, and come with standard pilot nose blanks which can be machined to hole size requirements. Both types are available with concentric or eccentric tool bit mounting, depending on tools to be used and type of work. Feed is automatic and continuous, controlled by a lead cam in the tool. Adjustable collars speed setting for location and depth of cut.

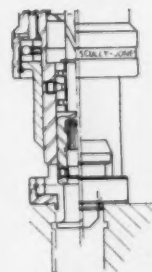
For more information about **building block design recessing tools**, contact your Scully-Jones representative or distributor, or call direct: BIsHop 7-5900.



Scully-Jones and Company
1915 South Rockwell Street, Chicago 8, Illinois



Pilots in fixture bushing



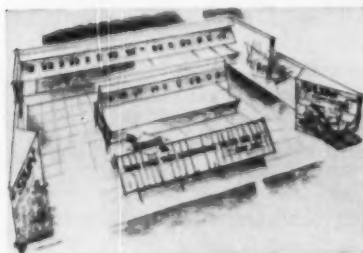
Pilots in the work



Does it make sense to shop around for petroleum products when you can get the best of everything from one source? Not when you can save time and money by dealing at Sun's "Supermarket," a single source of hundreds of quality petroleum products.

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Be sure to visit the Sun exhibit at the Machine Tool Builders Show in International Amphitheatre, Chicago, Illinois. Sept. 6-16. Booth 1513.

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...WITHOUT CUTTING, WITHOUT CHIPS**

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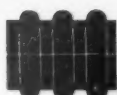
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A SUBSIDIARY OF THE CLEVELAND TWIST DRILL COMPANY
Stockrooms: New York • Atlanta • Cleveland • Detroit
Chicago • Dallas • Los Angeles • San Francisco



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Machine Tool Show near the main entrance



Here are thread  and form  grinders

that give you toolroom precision plus **+** production line speed.

Plunge grind threads  long in a turn and a half 

or traverse grind long threads as fine as **60 pitch** 

And you have a choice of Crushtrue®  wheel dressing

(or multi-rib  or single-rib  diamond wheel-dressers) with

manual  or automatic  crushing. Furthermore, Crushtrue

dressing is ideal for grinding intricate profiles. 

Sheffield's versatile standard Thread and Form Grinders (Model 101, illustrated, capacity 7" diameter x 12" long; Model 103, 7" diameter x 24" long) are equally at home in the tool room making one of a kind precision threads, or in the production line plunge grinding thousands of threaded or profiled parts.

Wheels may be diamond dressed . . . or Crushtrue® dressed for these advantages:

Greater production: wheel is sharper, grinds cooler. Faster stock removal: no dull flats, no burning, no loading up. Faster redressing: wheel is redressed in seconds. Highly accurate: tolerances on width within .0002", radii within .002", straight sides within .003". RMS finishes as low

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May we send you TFG 1159 catalog on models 101 and 103 and Bulletin CR 355 on the remarkable advantages of Crushtrue® grinding?

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Corporation  Dayton 1, Ohio

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September 1960

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Revolutionary new

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Vanadium Carbide Bandsaw

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- JET BAND** has high fatigue resistance!

Write for full information
MILLERS FALLS COMPANY
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**MILLERS FALLS
TOOLS**

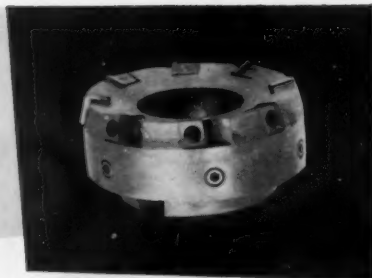
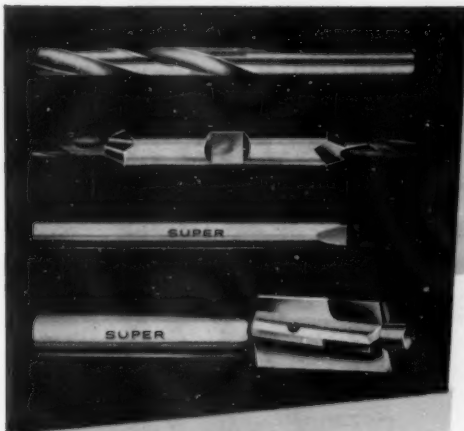
SINCE
1868

HAND TOOLS

PRECISION TOOLS

METAL CUTTING SAWS

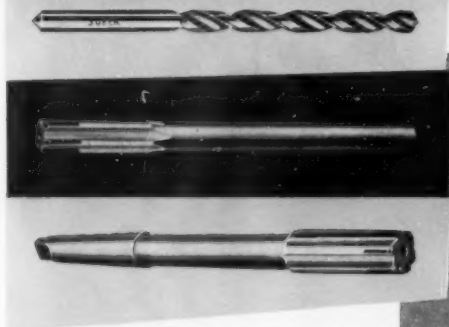
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Super Tool Company makes the finest quality Carbide tools available. Only materials of the highest quality go into the manufacture of these tools, and the result, whether it is a solid or Carbide tipped tool, assures longer life and greater productivity.

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S U P E R T O O L C O M P A N Y

21650 HOOVER ROAD

Division of Van Norman Industries, Inc.

DETROIT 13, MICHIGAN

September 1960

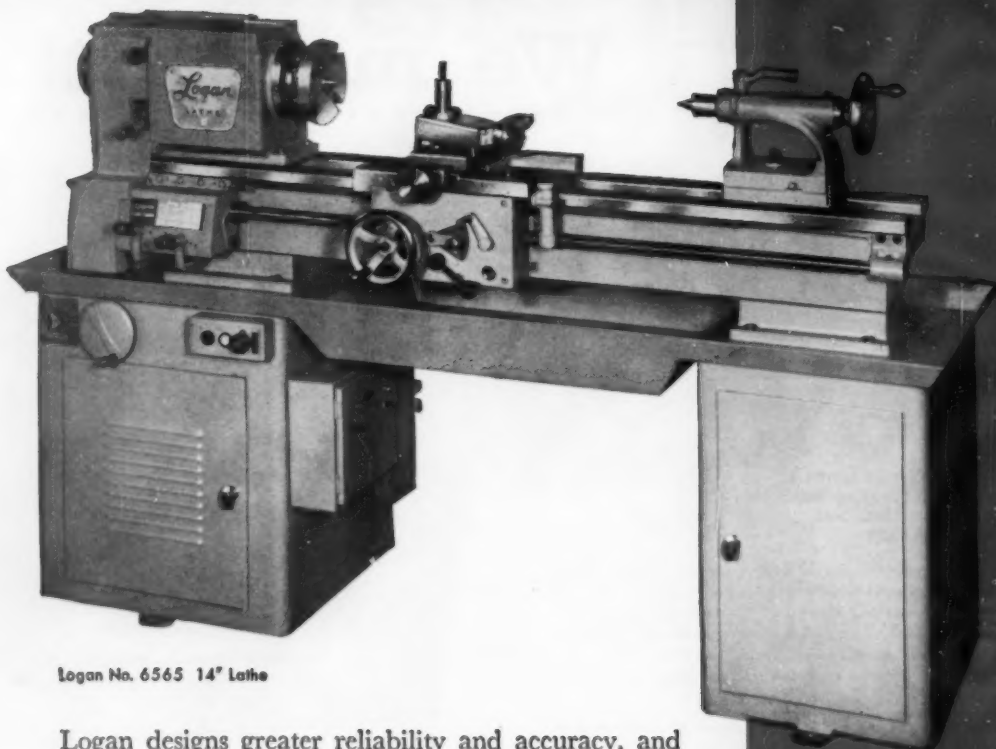
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its specifications add up
to high production capacity

Logan

14" Lathe



Logan No. 6565 14" Lathe

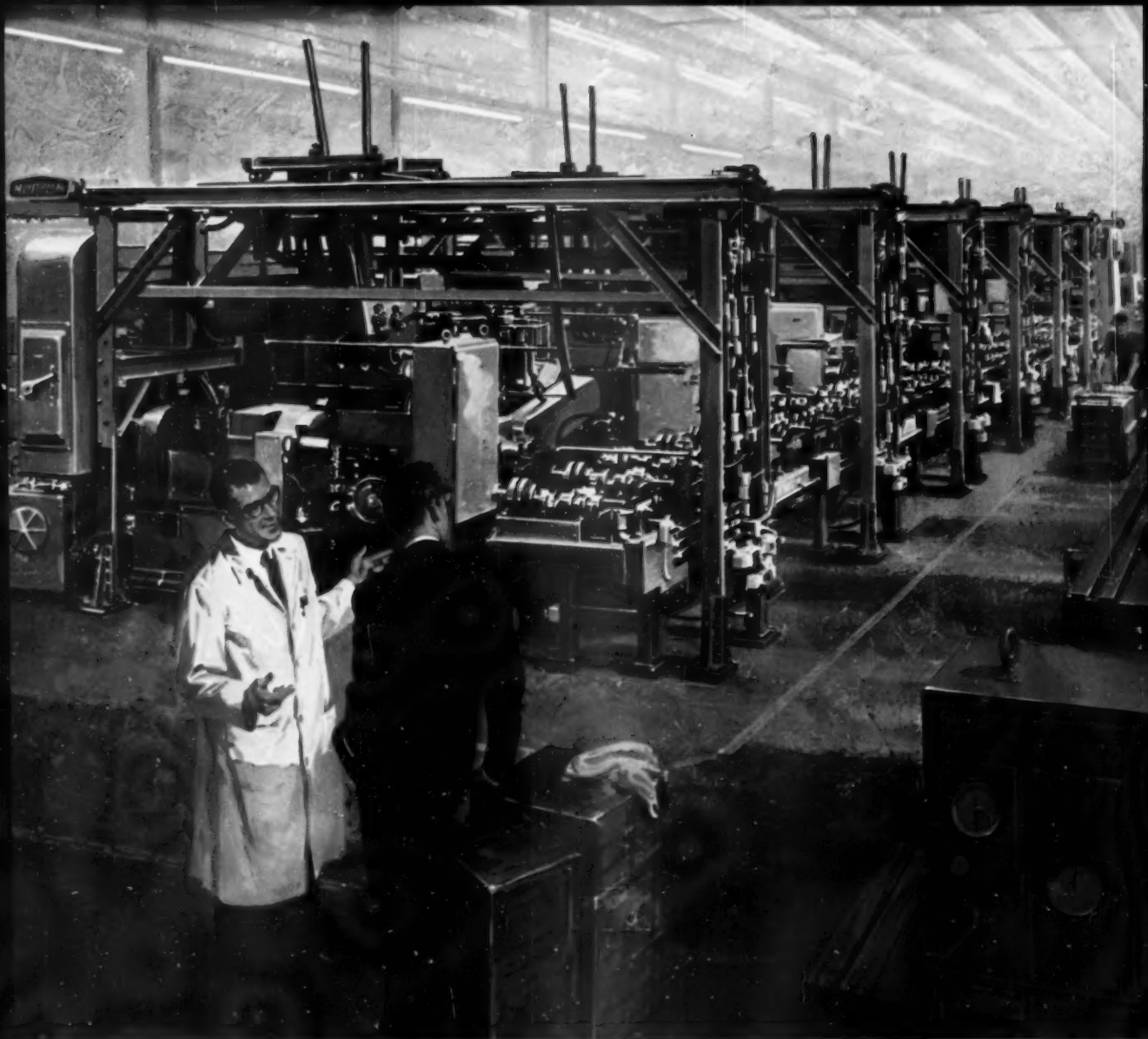
Logan designs greater reliability and accuracy, and longer life into its lathes by a generous combination of high-quality features. For instance—

- An oversize spindle with $1\frac{1}{8}$ " bore turns on four super-precision ball bearings with built-in preload
- A variable-speed drive lets you change speed while work is turning—without shifting belts
- A warp-free lathe bed with high, strong walls braced by oversize ribs to withstand heaviest stresses; two V-ways and two flat ways are flame-hardened and precision-ground.

There are many more reasons why this and other Logan Lathes have a greater capacity. The specifications tell the story. Write for literature and complete information.

- Spindle speeds to 2000 rpm.
- $1\frac{1}{2}$ " Levermatic collet chuck capacity
- $14\frac{3}{8}$ " swing over bed
- 9" swing over saddle cross slide
- 40" between centers

LOGAN ENGINEERING CO. Dept. U-960 4901 Lawrence Ave., Chicago 30, Ill.



And now . . .
Norton Automatic Transfer Machines
Multiply the "Touch of Gold"

The new Norton Transfer Type Crankshaft Grinder is actually many cylindrical grinders in one . . . in which adjusting, controlling, gaging, transferring and all other manual operations have become fully automatic! Once again the Norton "Touch of Gold" aids in mass-producing . . .

swiftly, accurately, economically.

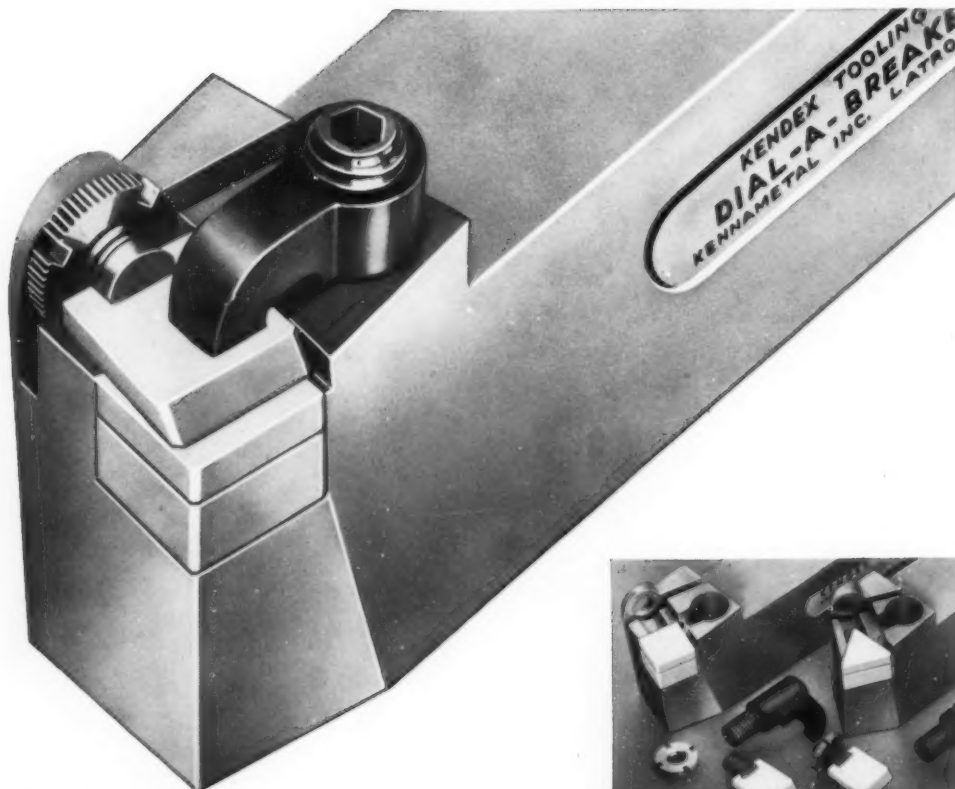
To the development of grinding machines — ranging from the smallest and simplest to the largest and most complicated — Norton brings the longest and broadest experience. See your Norton Man about putting this experience to work for you.

NORTON COMPANY, Machine Tool Division, Worcester 6, Mass.



75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHRMANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
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NEW KENDEX* DIAL-A-BREAKER*

Easily adjustable . . . attached chipbreaker

Quickly, easily . . . set the chipbreaker where you want it, regardless of holder position. The new Kendex Dial-A-Breaker eliminates fumbling and fussing while changing and adjusting chipbreakers and inserts. Chipbreaker is brazed to its adjustment screw. *It can't fall out, and the breaker setting may be retained while indexing or changing inserts.*

You no longer need a different breaker for every cutting job. Now you just turn the dial and position one chipbreaker for *several* jobs. Minimum of parts to stock . . . only two chipbreakers required for 70 styles and sizes of holders.

Close ganging of tools presents no adjustment problems with the

*Trademark

Kendex Dial-A-Breaker. All changes and adjustments . . . chipbreaker and insert . . . can be made from the top of the holder. (The clamp screw is also accessible from the bottom of the tool when mounted in an inverted position on the rear carriage.)

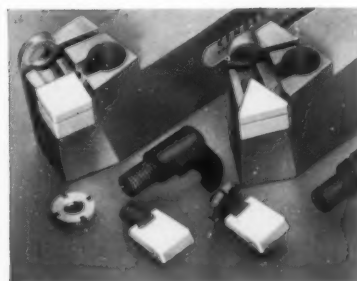
Kendex Dial-A-Breaker Tool Holders have the same basic design and accommodate the same solid Kennametal shims and "throw-away" inserts as used in standard Kendex holders. They are available in positive or negative rake, and with square or triangular inserts.

Get more information. Ask your Kennametal Representative for a demonstration . . . or write KENNAMETAL INC., Latrobe, Pa.

33501

SEE IT IN CHICAGO SEPT. 6-16
MACHINE TOOL BUILDERS SHOW
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PRODUCTION ENGINEERING SHOW
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 **INDUSTRY AND
KENNAMETAL**
... Partners in Progress



Holders illustrated with clamps and chipbreakers removed show positive seating of both triangular and square inserts. When not required, tool may be used without chipbreaker, with clamp set directly on the insert.



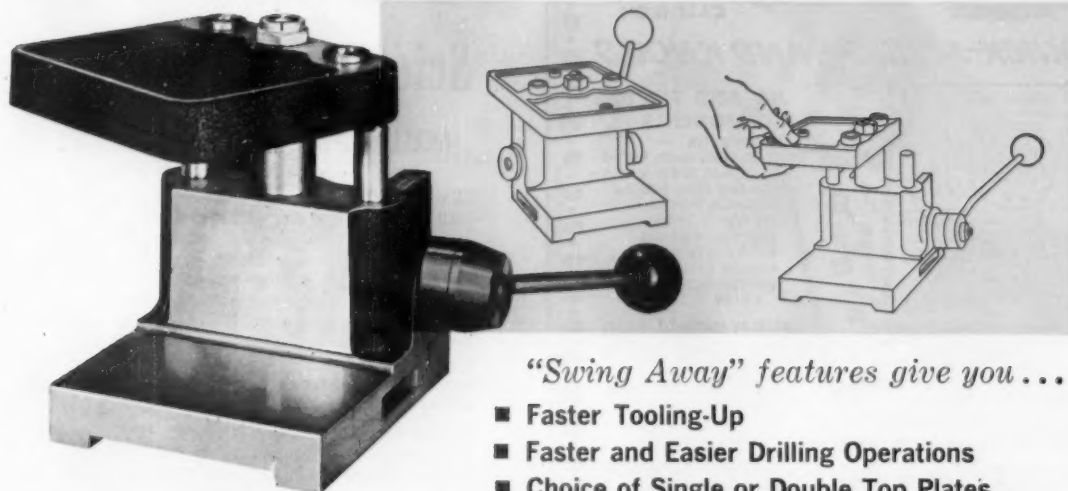
Easily accessible for adjustments. Permits close ganging of tools.



Easy adjustment, regardless of tool position. Just release the clamp and "dial" the breaker to any position desired.

tool quickly for long or short runs!

ABC LIFT SWING DRILLING FIXTURES

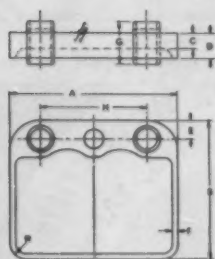


"Swing Away" features give you ...

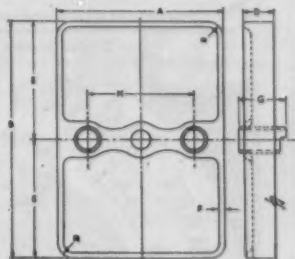
- Faster Tooling-Up
- Faster and Easier Drilling Operations
- Choice of Single or Double Top Plates

INTERCHANGEABLE TOP PLATE ENGINEERING DATA

Top Plate Dimensions



Style 1 Single



Style 4 Double

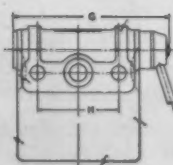
Top Plate Sizes

Top Plate Style	Top Plate Number	A	B	C	D	E	F	G	H	R
1	2201	2 1/2	2 1/2	1/2	1/2	7/16	—	3/4	1 1/2	1 1/2
4	2204	2 1/2	3 1/2	1/2	1/2	1 1/16	—	3/4	1 1/2	1 1/2
1	3201	3 1/2	3 7/8	1/2	1/2	3/4	—	1	2 1/2	3/4
4	3204	3 1/2	5 1/2	1/2	1/2	2 1/16	—	1	2 1/2	3/4
1	4201	4 1/2	3 1/2	1/2	1/2	3/4	3/16	1	2 1/2	1/2
4	4204	4 1/2	6 1/2	1/2	1/2	3/4	3/16	1	2 1/2	1/2
1	5301	5 1/2	5	3/4	1	3/4	3/16	1 1/2	3 1/2	3/4
4	5304	5 1/2	8 1/2	3/4	1	4 1/4	3/16	1 1/2	3 1/2	3/4

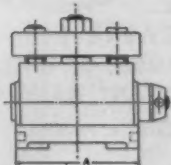
Larger sizes and other style single top plates available.

FIXTURE BASE ENGINEERING DATA

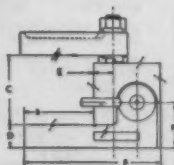
Fixture Base Dimensions



Top View
(Top Plate Removed)



Front View



Side View

Fixture Base Sizes

Lift Swing Base Number	A	B	C	C Shut suggested	C Open max. clamp	D	E	F	G	H	R
2220	2 1/2	1 1/2	1 1/2	1 1/2	2 1/2	1	1/2	3/4	3/4	1 1/2	1 1/2
3220	3 1/2	2 1/2	2	2 1/2	3	1	3/4	4 1/2	5	2 1/2	1 1/2
4220	4 1/2	2 1/2	2 1/2	2 1/2	3 1/2	1	3/4	5	5 1/2	2 1/4	1 1/2
5330	5 1/2	3 1/2	3	3 1/2	4 1/2	1	1	6 1/4	6 1/4	3	2
5340	5 1/2	3 1/2	4	4 1/2	5 1/2	1	1	6 1/4	6 1/4	3 1/2	2
5350	5 1/2	3 1/2	5	5 1/2	6 1/2	1	1	6 1/4	6 1/4	3 1/2	2

Larger sizes available. For tooling suggestions and complete engineering data write for Catalog LS-60-1.

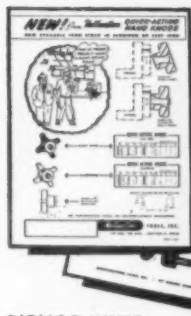


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FLANGED NUTS
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Northwestern

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Please send us your resume as soon as you can.

BOX NUMBER 184

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Write for
Manual E-9.

Drill a maximum number of holes in one pass—in any material. Holes can be as close as twice drill diameter. Zagar gearless drillheads are built as a complete unit or may be adapted to any standard drill press. Send us your part drawing and we will submit our quotation.

Zagar INCORPORATED
23892 LAKELAND BLVD. • CLEVELAND 23, OHIO

USE MORE SPINDLES TO DO MORE WORK
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The Tool and Manufacturing Engineer

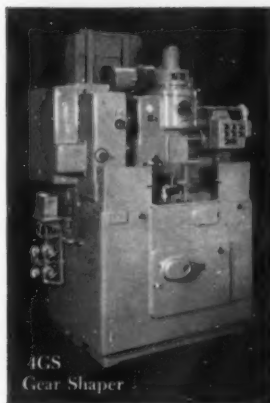


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NON-INVOLUTE PARTS

FELLOWS GEAR SHAPERS DO DOUBLE DUTY



4GS
Gear Shaper

Fellows Gear Shapers are not limited to the production of gears alone. They are valuable production machines ideal for the manufacture of many types of parts, of both involute and non-involute form.

As gear shapers, they provide high production rates in the manufacture of internal and external spur and helical gears. As general purpose production machines, they also make possible the economical production of irregularly shaped parts . . . in many cases doing in one simple operation what would require several operations using conventional shop tools.

Your Fellows representative will gladly give you the facts on how the complete Fellows line of production and inspection equipment helps increase production and cut costs. Ask him, or write direct.

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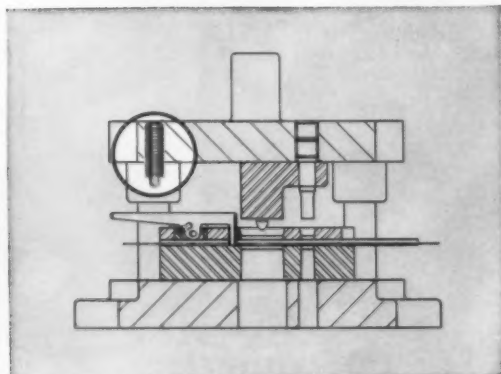
THE
PRECISION
LINE

Fellows

Gear Production Equipment

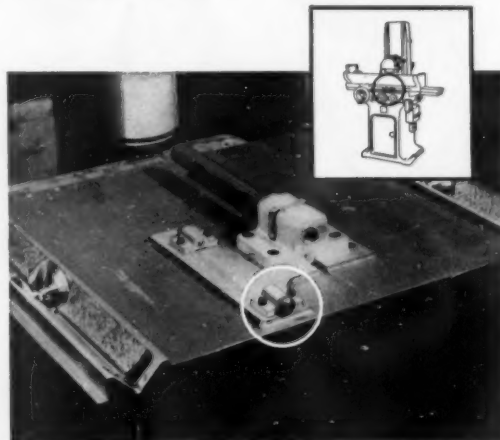
Practical Tooling Tips

Number 2 of a series.

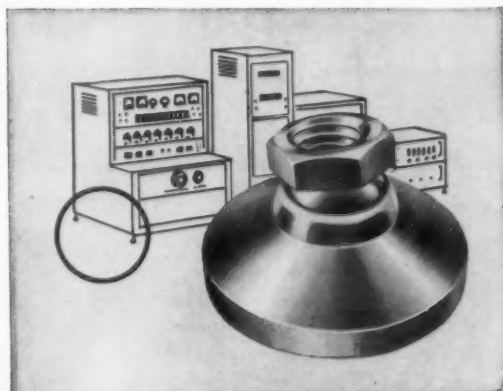


TO STOP SMASHING DIE STOPS, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 50 sizes.

Substituting simple, off-the-shelf Vlier Tooling Accessories for complicated, custom-made devices in both tooling and original equipment applications can result in important savings. Why not put them to work in your plant?



TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.



TO LEVEL MACHINE TOOLS, electronic racks, benches, etc., use the standard Vlier leveling pad. The pad swivels to 7½° each side of the center line; adjusts automatically to uneven surfaces. Unique ball-joint design distributes weight over entire pad surface.



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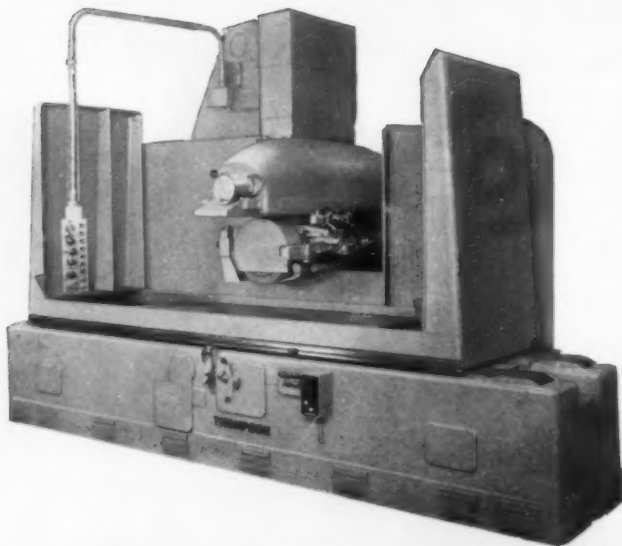
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**THOMPSON
TYPE CX PLUNGE-MATIC GRINDER**
36" x 48" x 72"

This grinder features Thompson's new and exclusive "CYBERMATIC PENDANT CONTROL" which completely eliminates the wheel head elevating hand wheel. All vertical movement of the wheel head, both automatic and manual, is accomplished effortlessly by dials on the pendant control.

MODERN

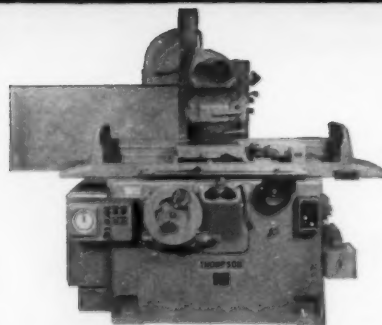
Thompson

to increase your production



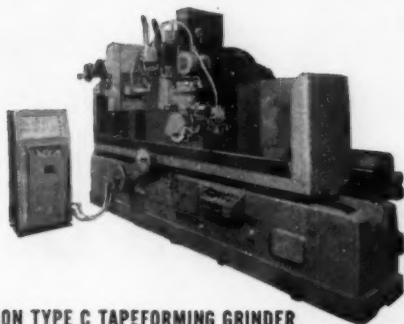
THOMPSON TYPE SUPER B GRINDER
12" x 16" x 36"

The outstanding feature of this Super B Thompson grinder is the 10 HP in-built wheel head motor on a spindle equipped with the world famous MALCUS BLOCK BEARINGS. These bearings are pre-loaded—self-adjusting—cold running—rotationally stable—vibrationless and free from wear. Other features are: Dial type cross feed with 14" of stroke—Tape bed way covers—Thompson Hydra-Cool Hydraulic System with separate hydraulic sealed oil sump—Electro-Autosizing in-process gauging for solid or interrupted work surfaces with automatic spark out to move table to loading position with Autosizing gauge control.



THOMPSON TYPE 2F GRINDER
8" x 12" x 24"

Equipped with a 3 HP 1800 RPM wheel head and a 12"x1"x4" grinding wheel, special features on this machine include a table mounted double roll wheel crushing device consisting of 1 work roll and 1 master roll with timed dressing cycle for wheel crushing—9" wheel head cross feed travel—5 to 90 FPM table speed using Thompson Hydra-Cool Hydraulic System.

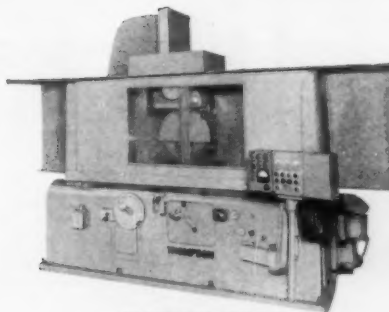


THOMPSON TYPE C TAPEFORMING GRINDER

14" x 28" x 60" with 10" of vertical or horizontal form control

Numerical control consists of Thompson-Ramo-Wooldridge, Inc. Director System utilizing 8-channel punched tape with transistorized module-construction. This system provides numerical control to 3 axes of which 2 axes are selective. Wheel head spindle can be rotated in a horizontal plane for template grinding with a large diameter wheel.

This machine is designed for grinding sophisticated continuous path contours.



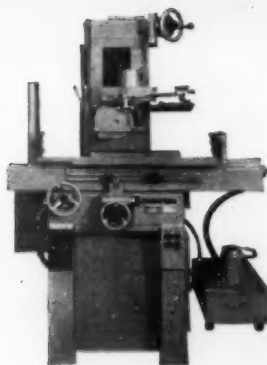
**THOMPSON TYPE C
ELECTROLYTIC FORM AND FACE GRINDER**
18" x 28" x 48"

This machine is equipped with a 3000 ampere ANOCUT electrolytic power unit using formed 16 pitch 90° serrations in an 18" dia. non-diamond wheel. A stock removal rate as high as .250 cu. in. per minute can be accomplished on the super alloy tool steels with this new electrolytic grinder.

MACHINE TOOLS

efficiency

SEE THEM AT OUR BOOTH NO. 850
MACHINE TOOL EXPOSITION, 1960



THOMPSON TYPE D GRINDER

6" x 14" x 18"

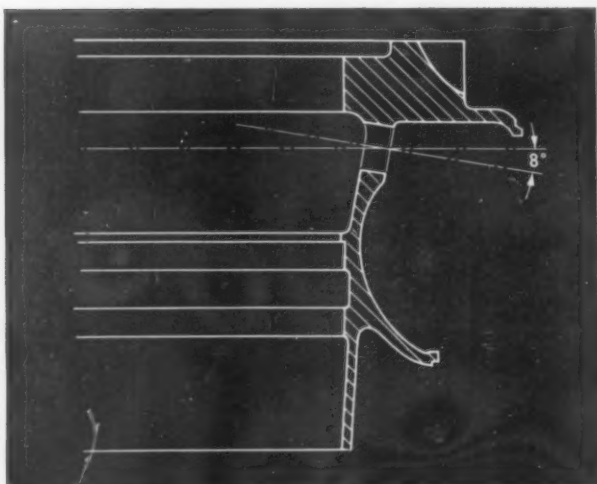
This grinder features TRAVATROL power feed to the table without the use of table reverse dogs. Table stroke is controlled by dials set from a scale reading located on front of table. Table speed is infinitely variable from 12 to 35 feet per minute with manual feed also provided. Other features include: A head mounted Hoglund contour dresser manually operated from template with a 10 to 1 ratio covering a contour 1" wide and 1/2" deep.

THE THOMPSON GRINDER COMPANY • SPRINGFIELD, OHIO

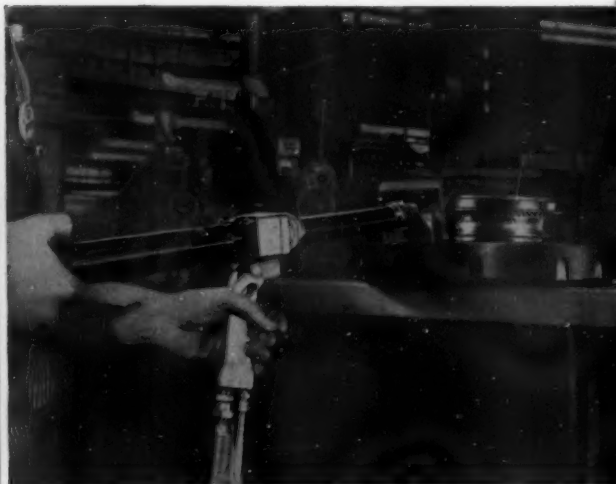
"Keep *Thompson* in mind for that daily grind"



How one aircraft parts subcontractor solved a tough production problem



Sectional drawing showing the inclination of hole at 8° to center line. Center lines of holes are required to be true within .010".



Close-up of Broach Gun, jig and fixture, showing ease of operation.

PROBLEM: MAKE 90 HOLES .281" SQUARE IN
13" DIAMETER STAINLESS STEEL RING TO $\pm .005$ " TOLERANCE

SOLUTION: USE CP PORTABLE BROACH GUN
AND AN INEXPENSIVE FIXTURE

B. H. Aircraft Co., Inc., of Farmingdale, N. Y., is making a missile engine thrust chamber component for a major engine manufacturer. The problem of producing such close tolerance square holes could have been a major stumbling block. However, by using a CP Portable Broach Gun and a simple jig and fixture, these components are being produced in quantity with *never a reject!*

Right: Broaching operation at B. H. Aircraft Co., Inc., showing simple jig and fixture. The portability of the CP Broach Gun and its self-contained Power Cell makes this an easy one-man operation.



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Completed part, with broach used to finish holes to .281" square.

Here are some of the things you can do with the
NEW CP Portable Broach Gun

CONVERT ROUND PILOT HOLES TO THESE SHAPES:



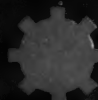
SQUARE



HEX



OVAL



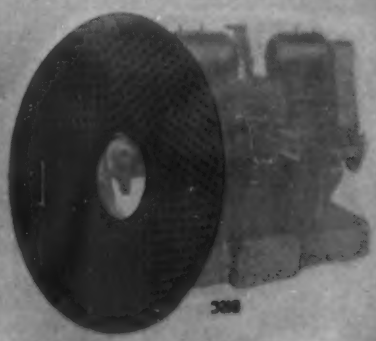
SPLINED



KEYED

Using the CP Portable Broach Gun gives you a completely new technique in broaching. You take the tool to the work. Broach is inserted in round pilot hole and one squeeze of the trigger forms and finishes the hole. The broach pulls a clean, "mirror finished hole," every time to $\pm .0002$ " accuracy. Self-contained CP Power Cell weighs only 58-pounds; operates on shop air lines and furnishes oil pressure up to 7,000 psi.

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 Precision-engineered extending wheels to



OSC



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FOOT WHEEL



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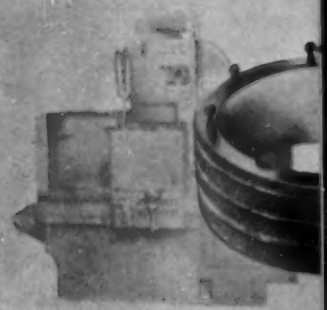
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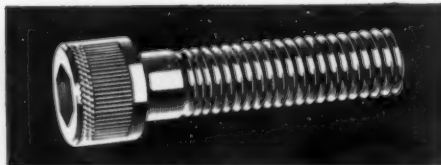


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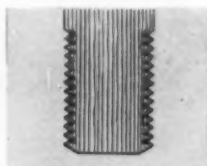
HOW THE NEW UNBRAKO CAP SCREW GOT ITS EXTRAORDINARY STRENGTH



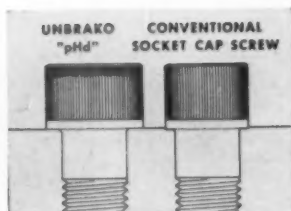
Sometimes "how it got that way" gives a good idea of "how well it will work."



It used to be that all socket head cap screws were machined from bar stock, but research revealed that fatigue failures were most likely to occur where the natural lines of strength in the metal were cut. So SPS began forging the heads of UNBRAKO cap screws . . . thus maintaining good flow lines and increasing fatigue strength.



A similar problem in the threads was solved in a similar way. The threads—even more fatigue prone than the head—had always been cut or ground. But now threads were pressed in by precision dies. Once again, maintaining the flow lines of the metal added greatly to the screw's strength . . . and, of course, to the mechanical reliability of your assemblies.



Still, however, there was a lot of room for improvement. Research indicated that there simply was not enough load bearing area under the head. So SPS introduced the UNBRAKO pHd* cap screw, with a larger head diameter and more powerful wrenching socket. The result? Up to 2½ times as much holding power *without* indenting bolted material. This permits higher preloading, which in turn helps prevent loosening under vibration.



One more important stride remained. In the root of the thread were sharp corners where fatigue failure could begin. At the SPS Laboratories for Advanced Research, photoelastic studies made strikingly evident the value of a smoothly radiused root over a conventional flat thread root. And so was born the UNBRAKO Hi-Life thread form, which reduces stress to a minimum, distributes the remaining stress evenly, and increases fatigue life up to 100%.

BOOTH 232
Production
Engineering
Show

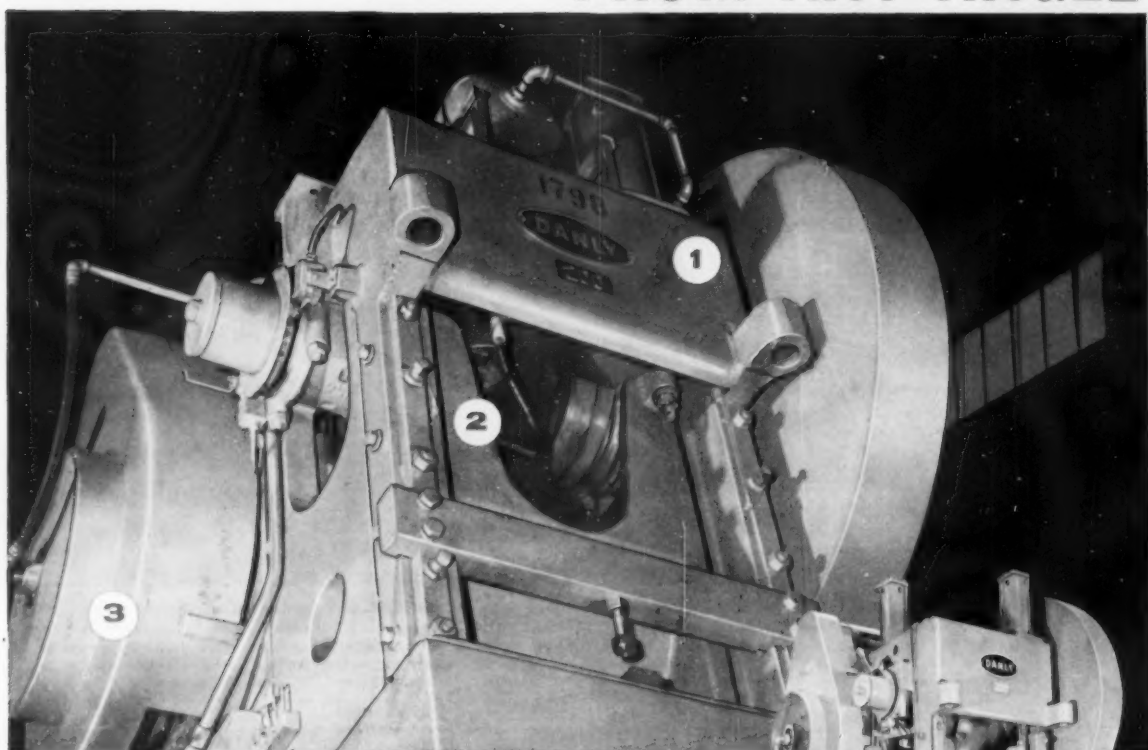
Now you have at your disposal a socket screw that is stronger in the head, stronger in the thread. The UNBRAKO pHd with Hi-Life threads is the only advanced fastener for the '60's. All this at no additional cost. Write Standard Pressed Steel Co. INDUSTRIAL FASTENER Division, SPS, JENKINTOWN 37, PENNSYLVANIA.

SPS

*pHd stands for "proper head design"

where reliability replaces probability

FROM ANY ANGLE



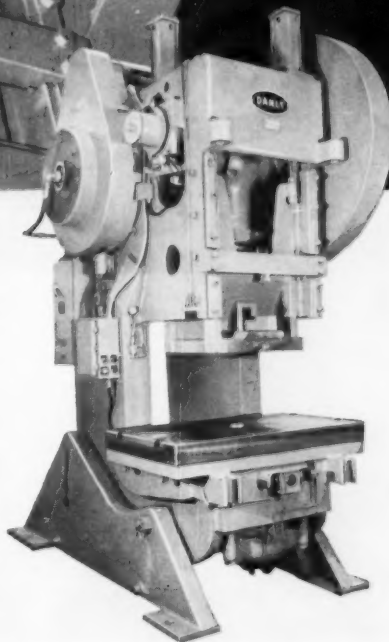
IT COSTS LESS TO RUN A DANLY O.B.I.

① **Compare a Danly welded-steel frame**, for example, with any comparable press available. A Danly frame is designed to the most rigid deflection standards, with extra brawn to resist shock and vibration. This means longer die life, less downtime for die maintenance, and more accurate stampings, too.

② **Compare the drive . . .** the forged and heat-treated crank shaft, the bronze-bushed bearings, the quiet gearing. Danly O.B.I.s are built to defy breakdowns . . . to give you bonus productive hours.

③ **Compare the clutch . . .** the same patented air friction clutch that has made Danly presses standouts in major stamping plants around the world. Because of its low inertia design, and long-life floating friction inserts, your maintenance department can almost forget it's there.

Compare a Danly O.B.I. from *any* angle. You'll find it's built for lower cost, more dependable operation. Write for the new Danly O.B.I. Catalog and the detailed specifications will convince you.



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Booth No. 1250.

DANLY



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September 1960

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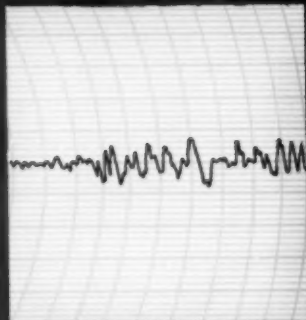
309

THESE SURFACE TRACES PROVE

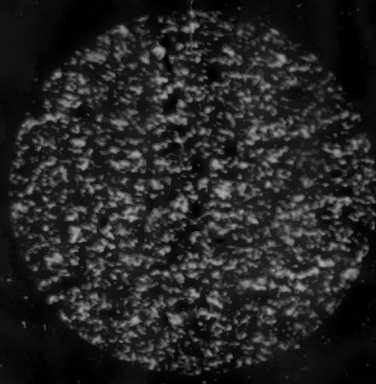
when you use Formbrite, Anaconda's superfine-

STANDARD DRAWING BRASS

(grain size, .045 mm) — after 40% elongation



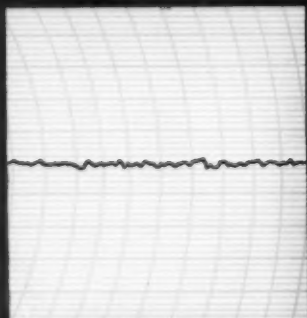
ENLARGED SURFACE TRACE showing the roughness that causes "orange peel" effect in the working of standard drawing brass. Smoothing such mountains down to the valleys takes a lot of cutting—cost of polishing compounds runs high—production is low—bottlenecks hampering operations.



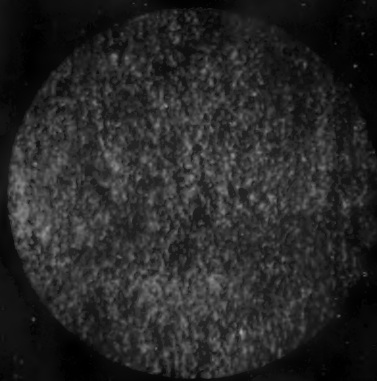
THE SURFACE of the stretched standard drawing brass sample looks like this when seen in oblique illumination and magnified 20x. For small deep-drawn products, it might take up to five polishing wheels to finish a surface with roughness of this order—even at low machine speeds.

FORMBRITE DRAWING BRASS

(grain size, .005 mm) — after 40% elongation



ENLARGED SURFACE TRACE showing Formbrite's smoothness even after deformation, the test of polishing characteristics of a drawing brass. Little hills like these are easy to level. The trace explains why polishing savings reported by Formbrite users are usually 40% to 50%.



WHEN SEEN IN OBLIQUE ILLUMINATION and magnified 20x under the microscope, the stretched Formbrite surface looks like this. Even in such deep-drawn products as pen caps, only a light cut and a color buff are needed for a jewelers' finish—often a color buff alone does the job.

DESPITE its superiority, Formbrite costs no more than standard drawing brass. It is produced in the following brass alloys: Yellow Brass, Cartridge Brass, Gilding, Commercial Bronze, Red Brass, and Low Brass. The Formbrite process is also applied to brass wire alloys for cold-heading and upsetting pur-

poses—for a stronger, springier, more abrasion-resistant product.

Get the full details from your American Brass representative, or write: The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

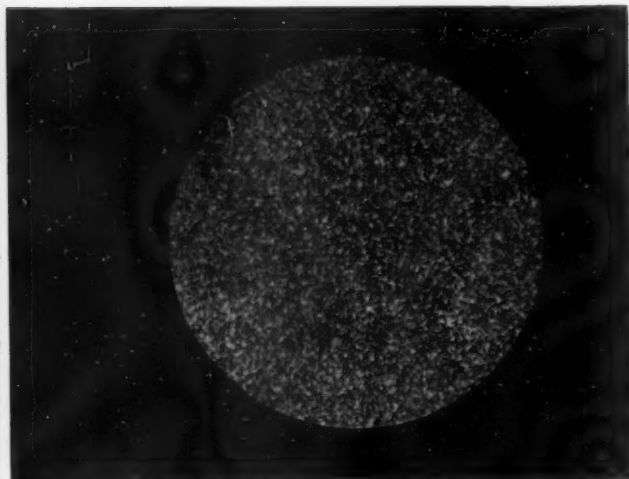
6029

YOU CAN CUT POLISHING COSTS

grain drawing brass



THIS IS THE MICROSTRUCTURE of the standard drawing brass sample at 75x magnification. The coarse grain structure is typical of the drawing brass that has for decades been used for stamped or drawn brass products. It is the basic reason that polishing costs have run high.



THIS IS THE MICROSTRUCTURE of the Formbrite sample, magnified 75x. The uniform, superfine-grain structure, produced by special procedures of rolling and annealing, explains the relatively smooth surface trace of the stretched Formbrite sample, at the left.

FORMBRITE®

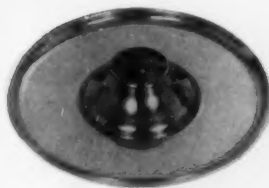
Superfine-grain drawing brass

A PRODUCT OF

ANACONDA®

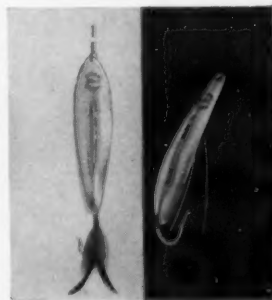
MADE BY THE AMERICAN BRASS COMPANY

The outstanding feature of Formbrite is easy polishing. But there's something else you should know about it. Formbrite is stronger, harder, springier, and more scratch resistant than the usual drawing brasses. Yet it retains remarkable ductility for forming, stamping, drawing, and embossing. In many instances, these qualities have made it possible to use thinner gage metal.

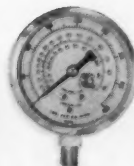
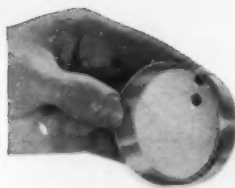


The maker of this tray, after switching from ordinary drawing brass to Formbrite, found he had achieved a cost reduction of 25% in the cutting operation and 42% in the finish buff—and a healthy boost in production rates.

These fishing lures, first made from ordinary yellow brass, are polished for plating by tumbling. After the switch to Formbrite, manufacturer found he had cut his polishing costs 40%. Small-size formed, drawn, or upset parts made of Formbrite often can be satisfactorily finished by the relatively low cost conventional tumbling methods.



A jeweler's finish on these deep-drawn products meant the use of five polishing heads, with regular drawing brass. With Formbrite, manufacturer uses two polishing heads for a light cut, another for a simple color buff, and runs machines faster. Savings run up to 40%.



When this gage case was made of Formbrite, the instrument manufacturer found he could drop the cutting operation and get a "mirror finish" with a light buff. The saving in finishing cost was 40%.

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(Drill Head Hunters, that is)

...like these:

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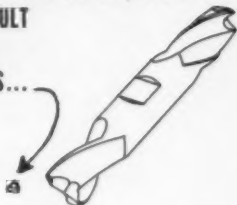
UNITED STATES DRILL HEAD CO.

Cincinnati, Ohio

CLIP AND FILE

END MILL TIPS YOU CAN USE

IMPROPER SPEEDS, FEEDS
RESULT
IN
THIS...

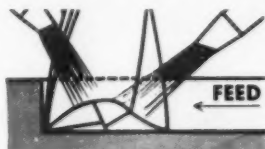


Improper speeds or feeds as well as a failure to use adequate cooling methods lead to rapid, excessive wear on end mills. If end mill users would observe good cutting tool practices on these problems they could cut their tool costs and obtain better overall performance. Follow chart below.

SPEED AND FEED CHART (SFM)

Material	Speed
Aluminum and Magnesium	400-600
Brass	200-500
Iron—Cast and Malleable	90-100
Steel—Cast, Soft Alloy	70-80
Steel—Hard Alloy	30-50
Steel—Stainless	50-80

Feeds vary with diameter . . . from .0002" to .0005" small sizes to .003" up in larger sizes—per RPM.



CUTTING FLUIDS

You will get a better finish to your work and far more mileage from End Mills if you achieve the best possible use of coolants. No brief statement can cover all situations, but best general advice is to use multiple streams—one on leading side of tool—one on back. Keep the flow heavy and steady.

GOT A PROBLEM?

Arrange a consultation with a Chicago-Latrobe Service Engineer. His experience can lead to a quick solution of your problem. Also—request comprehensive End Mill Speed and Feed Chart.

Best tip of all...

ASK YOUR
DISTRIBUTOR
FOR ...



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DRILLS • REAMERS • END MILLS
COUNTERSINKS • COUNTERBORES
CARBIDE TOOLS • SPECIAL TOOLS and
"LO-TORK" CHIP BREAKER DRILLS



Write Chicago-Latrobe or call your distributor

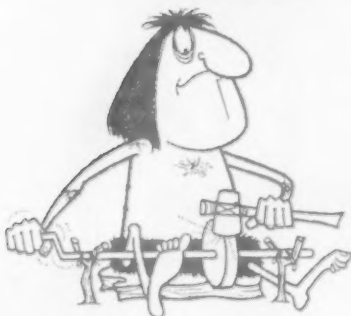
for CATALOG No. 60 Sixty-eight pages of illustrated
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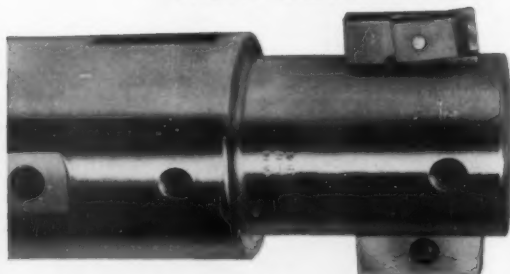
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Chicago 10, Illinois

Tired of
grinding your
"ROUGH-CUTTING"
TOOLS?



Save diamond-wheels, time
and temper! Use the new
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**DOUBLE-CUTTER
BORING BLOCKS**
from **LEHMANN**



INDEXABLE INSERTS

For a renewed cutting edge, just loosen
indexable bit, turn and tighten. Throw insert
away after all edges have been used.
Get the most speed and efficiency your newest
machine can deliver... eliminate roughing
tool regrinding and reduce downtime.

Two-cutter blocks are available from 2½"
through the full range of normal block sizes.

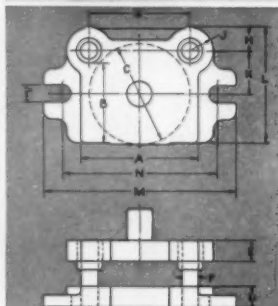
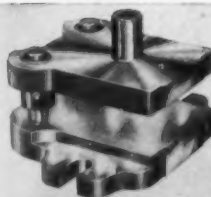
"See Lehmann first
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Standard or custom tooling.

**LEHMANN-FULTON
BORING TOOL CO.**

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Sets, Guide Posts, Bush-
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Leitz New **SIMPLEX**
TOOLMAKERS
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of 2" x 2" range
in .0001" at a
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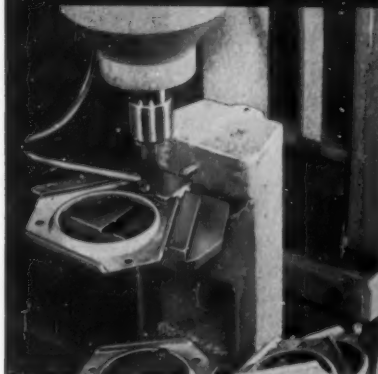
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OPTO-METRIC TOOLS, INC.
137TE VARICK STREET • NEW YORK 13, N. Y.

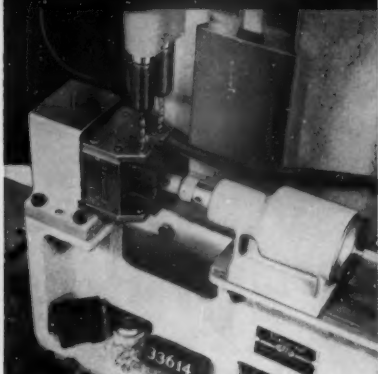
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The Tool and Manufacturing Engineer

TIME SAVED 58%



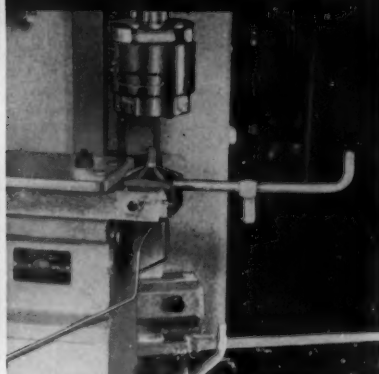
Tapping three $\frac{3}{8}$ "-18 holes in steel @ 1800 holes/hr. with #X-11 Piece Part Fixture.

TIME SAVED 87%



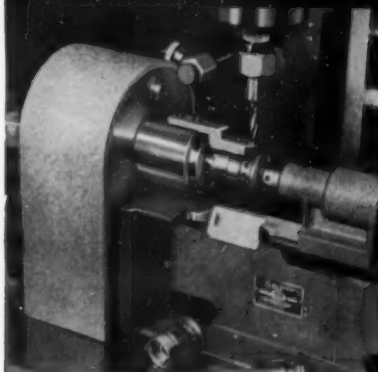
Drilling two #20 (161") holes in bakelite @ 1950 holes/hr. with #21 Horizontal Clamping Fixture.

TIME SAVED 63%



Threading two ends $\frac{3}{8}$ "-30 brass @ 1800 ends/hr. with #612 Air Vise.

TIME SAVED 75%



Drilling eight $\frac{1}{8}$ " holes in brass @ 1920 holes/hr. with #16 Vertical Indexing and Clamping Fixture.

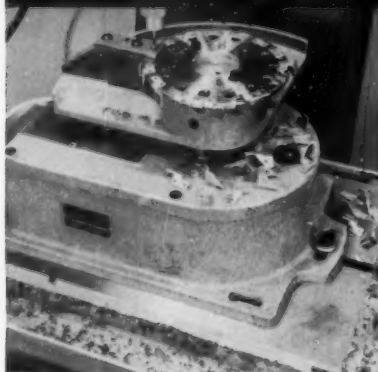
**can you
take
advantage
of these
savings**

TIME SAVED 67%



Drilling $\frac{1}{8}$ " hole through brass @ 2600 holes/hr. with #15 Vertical Indexing Fixture.

TIME SAVED 68%

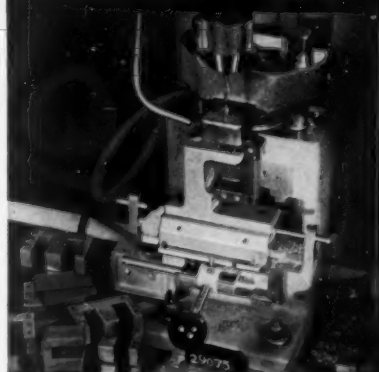


Tapping two 4-40 holes in steel @ 4400 holes/hr. with #18 Horizontal Indexing Fixture.

The average Snow machine pays for itself *completely* in 300 to 600 hours. That's only 9 to 17 weeks of 35 hours/week. A Snow machine can be idle 85% of the time and still pay for itself in one year.

Such savings are possible because Snow machines give two to four times the hourly production of non-automatic machines. 28 standard air-operated fixtures permit minimum tooling for each job. On your next job, let us show you what the Snow method can do. Send us your samples and prints.

TIME SAVED 88%



Drilling two $\frac{1}{8}$ " holes in steel @ 860 holes/hr. on #9 Universal Clamping Fixture.

Snow Manufacturing Company
Dept. T, 435 Eastern Avenue
Bellwood, Illinois (suburb of Chicago)

SNOW *master fixtures save dollars and days in tooling costs.*



Another New Fastener Idea From Parker-Kalon

The New PARKER-KALON **W-POINT** Socket Set Screw

T.M.









U.S. PATENT NO. 2,907,245

*Now you can get the highest degree
of holding power ever attained!*

30% more back-out torque 50% more resistance to vibration 50% more resistance to rotary slippage

Like many important advances in technology, the Parker-Kalon W-Point concept is simple and straightforward. In use, its superior performance and holding power will be demonstrated to your own satisfaction. Available from P-K distributors at no increase in cost.

A COMPLETE LINE OF SOCKET SCREWS TO MEET EVERY REQUIREMENT!

<p>SOCKET HEAD CAP SCREWS</p>  <p>Heads are of uniform diameter. Threads Class 3A tolerance. Available in standard sizes from #0 to 1 1/2" diameter in alloy steel and from #0 to 1/2" diameter in stainless steel. Available in 1936 and new 1960 "Pre-Lode" Series.</p>	<p>SOCKET SET SCREWS</p>  <p>Precision Class 3A threads, standard in Cup Point from #0 to 1" and in Flat, Oval, Cone and Half-Dog Points from #4 to 1/2". Cup Point also available in stainless steel.</p>	<p>SHOULDER SCREWS</p>  <p>Threads Class 3A tolerance. Heads are concentric with body for uniform, accurate assembly. Available in standard sizes from 1/4" to 1/2" diameter.</p>	<p>FLAT HEAD SOCKET CAP SCREWS</p>  <p>Seats flush when countersunk. Heads have uniform 82° angle. Threads Class 3A tolerance. Special alloy steel, heat treated. Available in standard sizes from #4 to 1/4".</p>	<p>BUTTON HEAD SOCKET CAP SCREWS</p>  <p>Heat treated alloy steel. Accurate hex sockets make for non-slip driving, prevent mutilated heads. Threads Class 3A tolerance. Standard sizes from #4 to 1/4".</p>	<p>SOCKET SETS</p>  <p>P-K is the only fastener manufacturer to provide socket sets, to meet your needs for precision-made socket head cap screws with split ring washers.</p>	<p>HEX KEYS</p>  <p>Made of special analysis alloy steel, scientifically engineered. Heat treated for optimum physical characteristics. Made to close tolerances.</p> <p>DOWEL PINS</p>  <p>SOCKET PIPE PLUGS</p> 
--	---	--	---	--	--	--

*Now you can get all of these famous P-K® quality
socket screws with or without*

the vibration-resistant **LONG-LOK® INSERT!**

Look at that groove! It's P-K's secret weapon against vibration. Filled with Polycap nylon-type polymer, it solves a thousand and one problems where vibration is present... where adjustment is required... where reuse is a factor, over a wide temperature range.

- Provides higher resistance to shock
- Higher percentage of reusability
- Superior thread engagement and locking force
- Eliminates need for lock washers, safety wires
- The Long-Lok insert is available on P-K Socket Head Cap Screws, Set Screws, Flat Heads, Button Heads, Shoulder Screws and Pipe Plugs.

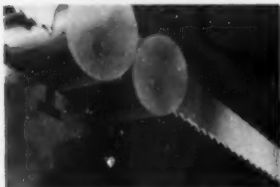


PARKER-KALON

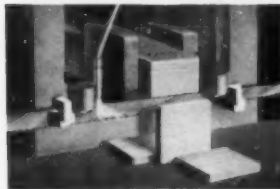
FASTENERS

Parker-Kalon Division, General American
Transportation Corporation, Clifton, New Jersey.
Offices and Warehouses in Chicago and Los Angeles.
KEEP AMERICAN INDUSTRY AT WORK... BUY P-K... MADE IN U.S.A.

Simonds offers you
3 TYPES of Metal Cutting
Band Saws:



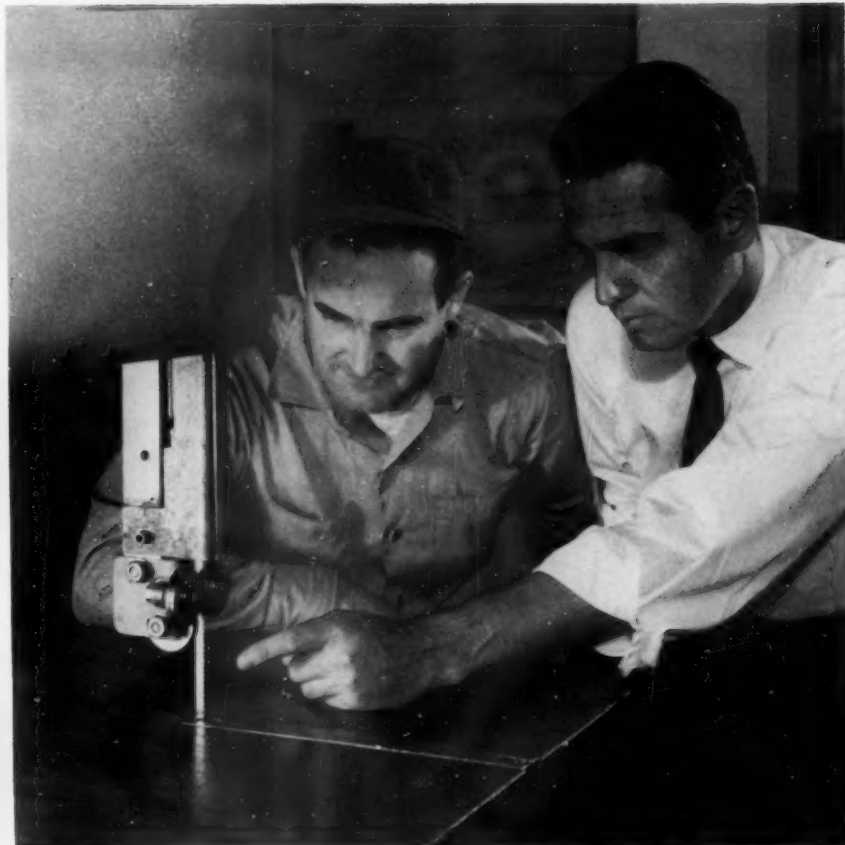
SUPER High Speed Steel . . . an entirely new concept in band saws, this super blade will give up to 3 times better performance than any other high speed steel blade.



Standard High Speed Steel . . . a tool of highest quality, designed for faster cutting and longer life than conventional metal cutting band saw blades.



Hard Edge Carbon Steel . . . a top quality blade well known for its versatility. Furnished in all standard widths and tooth styles for contour or cut-off work.



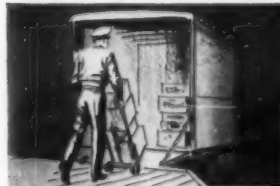
Local Skill. Your local Simonds Distributor is ready and able to help you solve your cutting problems. He's always "on call" for emergency service or engineering help.

SIMONDS PERFECTIONEERS EVERY ORDER with your Local Simonds Distributor's "Triple-S-Service"

(LOCAL SKILL — LOCAL STOCKS — LOCAL SPEED)



Local Stocks of your Simonds Distributor mean less money you have to tie up in inventory, and big savings in stockroom space.



Local Speed of your Simonds Distributor means fast delivery. Greater convenience, too, with one order, one invoice, one check covering many different items.

Back of the "controlled conditions" quality of every Simonds cutting tool is the "Triple-S-Service" of your local Simonds Distributor. He not only *stocks* and services your account with local *speed*, but provides a local source of technical *skill* and know-how.

As your local Simonds Distributor, he is thoroughly schooled in the proper application and use of Simonds cutting tools. And can help you *perfectioneer* your toughest wood or metal cutting jobs.

For the best combination of quality cutting tools and on-the-spot service that saves you time, work and money — use the "Triple-S-Service" of your local Simonds Distributor.

Factory Branches in Boston, Chicago, Shreveport, La., San Francisco and Portland, Ore. • Canadian Factory in Granby, Que. • Simonds Divisions: Simonds Steel Mill, Lockport, New York; Heller Tool Co., Newcomerstown, Ohio; Simonds Abrasive Co., Philadelphia, Pa. and Arvida, Que., Canada

SIMONDS
SAW AND STEEL CO.

FITCHBURG, MASSACHUSETTS



Get your local Simonds Distributor's

— For Local Stocks — Local Speed — Local Skill



AUTOMATIC UPSETTING!

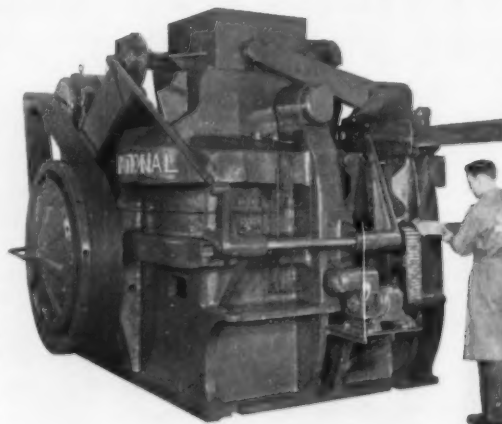
Let National Tong-Feed Forging Machines Produce Your Forgings at Lower Cost

Hot Forging is going automatic! Well, not *all* of it, but many forward-looking forge plants are taking a fresh look.

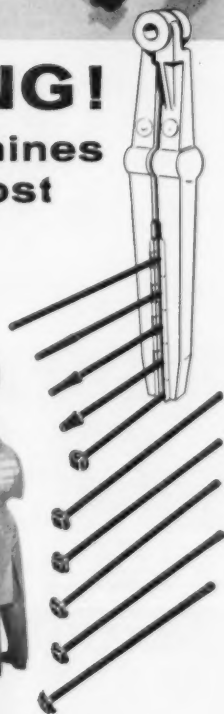
For example, all of the upset-type forgings above were made on National Automatic Tong-Feed Forging Machines. Seven sizes are now proved and presently operating in production: 1", 1½", 2", 3", 4", 6" and 7½".

The method offers extremely interesting opportunities of raising production while reducing labor and operating costs. May we help you investigate?

Let's start by looking over your jobs, preferably here in Tiffin. Here we can have a productive session devoted entirely to your plans, but without obligation.



National 4" Automatic Tong-Feed Forging Machine with discharge conveyor.



Founded 1874—DESIGNERS and BUILDERS of MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING PRODUCTION METHODS

NATIONAL MACHINERY CO.

TIFFIN, OHIO, U. S. A.

HARTFORD

DETROIT

CHICAGO



Here's why:

Reduce parts inventory. By using identical parts throughout the series (where feasible), and by designing the tools with built-in interchangeability features, Cleco has made it possible for you to *simplify and reduce parts inventory.*

Cost less to operate. No. 10 Series motors are more powerful, yet actually require less air per h.p. output. Well-balanced, and easy-to-handle, these tools are constructed of heavy duty material (high quality Ni, Cr, Mo alloy steel pinion and planet gears, for example) that can really take the demolishing punishment of high production operations. Friction-free clutch permits longer, *much longer* periods of maintenance-free operation.

Speed production, while improving quality con-

trol. No. 10 Series Drills and Screwdriver —Nut-Runners have design features that reduce time lost and rejects. *No. 10 Drills:* are equipped with 3-idler planetary gear trains for all gear reductions; have a low noise level; and develop $\frac{1}{2}$ h.p. Drill speeds range from 500 to 20,000 r.p.m. *No. 10 Screwdriver* —Nut-Runners are available in speeds from 500 to 5,000 r.p.m. Equipped with a no-drift locking device, No. 10 Screwdrivers have unequalled torque holding ability. They cannot over-torque, strip threads, crack plastic, or damage screw heads.

You will not believe that these tools could possibly have so many positive advantages until you see them for yourself, so contact your local Cleco® representative for a no-obligation demonstration. For specifications and literature, write:

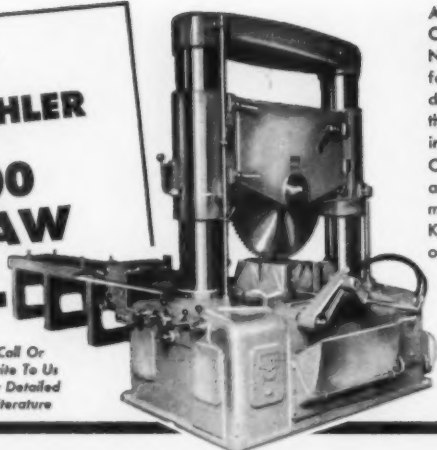


**A Division of REED ROLLER BIT COMPANY
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IN CANADA: Cleco Pneumatic Tool Company of Canada, Ltd., 927 Millwood Road, Leaside (Toronto), Ontario

**Introducing:
THE NEW OHLER
MODEL
KA-1000
COLD SAW**

Call Or
Write To Us
For Detailed
Literature



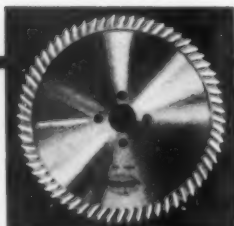
Another model has been added to the OHLER Cold Sawing Machines . . . The NEW Model 1000. It has all the latest features and embraces the OHLER tradition throughout the world as building the most advanced, economical cold sawing equipment.

OHLER Hydraulic Cold Sawing Machines are available in KA models for automatic and semi-automatic operations. The K models for semi-automatic operations only.

CAPACITIES

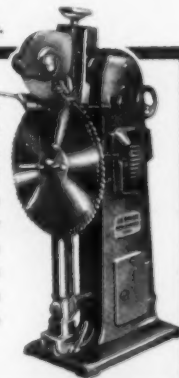
Model 400 5" Round
Model 630 10 3/4" Round
Model 1000 15 3/4" Round

We Can Help
On Your Cold
Sawing Problems.



Segmental Saw Blades Originated by OHLER are stocked in sizes from 12" to 63" diameter, and a wide range of pitches with bore and drive pin holes to suit all cold sawing machines.

MODEL 1500 OHLER Automatic Saw Sharpening Machines will grind the curved tooth form, and chamfer the alternate high teeth to produce the "Triple Chip" which is so essential to modern sawing.



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MACHINERY COMPANY
Machine Tools and Machine Shop Equipment



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**The
right
tool...
for
your
job!**



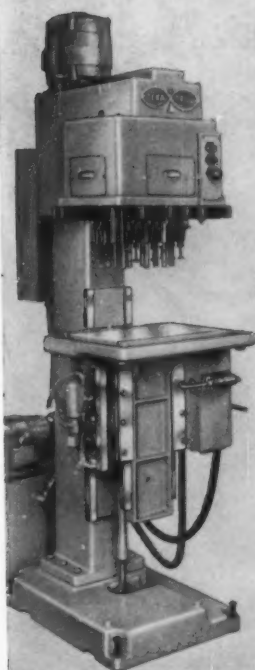
COMPARE!
(AT OUR EXPENSE)

**FOR POWER
FOR TIME SAVING
FOR LOW MAINTENANCE
FOR EASY USE**



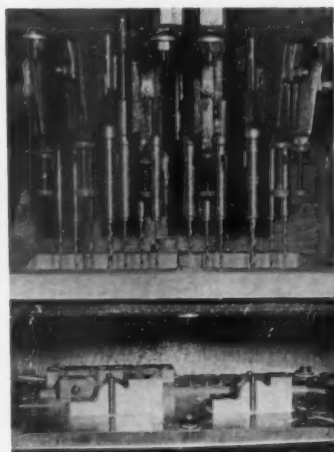
HYDRAULIC MULTIPLE SPINDLE DRILLING and TAPPING MACHINE

Send us one of your drilling or tapping problems for a free time study estimate. Find out how automatic cycle drilling and tapping with DEKA-DRILL can increase production and save time and money for you!



TWO COMPLETE CASTINGS IN 12 SECONDS!

COMPANY: Kleinschmidt division of Smith-Corona Marchant.



OPERATION: Drills three .156 holes $1\frac{1}{4}$ " deep and two $\frac{1}{4}$ " holes $1\frac{1}{4}$ " deep through aluminum extrusions.

TIME OF COMPLETE OPERATION: 12 seconds. Floor to floor—37 seconds!

TECHNIQUE: Nest plate consists of six stations. First and second stations drill three .156 holes $\frac{3}{8}$ " deep. Parts are turned over 180° in third and fourth stations and new parts placed in first and second stations and three .156 holes are drilled through. Parts completed by drilling two $\frac{1}{4}$ " holes through piece in same manner in fifth and sixth stations. Parts are clamped automatically during drilling cycle by 12 pressure pads on bushing carrier mounted on top leaf of Master Die Set fixture.

A DEKA DRILL CASE HISTORY

PRECISION TOOL AND MFG. CO. of ILLINOIS

DEPT. TE-90 1305 S. LARAMIE AVENUE, CICERO 50, ILLINOIS

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Find out how you can cut your costs with ROTOR TOOLS. Ask for free demonstration. Write for copy of Bulletin 53C. The Rotor Tool Company, Cleveland 32, Ohio.



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What HORACE DREVER has
to say about Lindberg heat
treating equipment



QUOTE from Mr. Drever's
unsolicited letter to
Lindberg Engineering
Company

Mr. Horace Drever, internationally prominent in the industrial heating field, is a Past-President of the Furnace Manufacturers Association and President of Drever Company, furnace manufacturers and commercial heat treaters.

"For the past three and one-half years, we have been operating one of your Type 243618 GVRT Furnaces along with a 500 CFH Lindberg Hyen generator in our commercial heat treating division. We are extremely pleased, not only with the fine quality of work turned out by this equipment but also its relatively trouble-free operation. As evidence of our complete satisfaction we have ordered another Lindberg Furnace of this type."



Lindberg Furnaces in operation
at the Drever Company, Bethayres,
Pennsylvania.

We are happy that Mr. Drever, a furnace manufacturer in his own right, originally chose Lindberg equipment for his heat treating plant and that its satisfactory service prompted an additional order. The second Lindberg Furnace is now in production at Drever Company, as the adjacent photo shows. Bless those satisfied customers! If you have a product or process in the metal or ceramic field requiring the application of heat you can depend on Lindberg's engineering and design know-how to provide exactly the right equipment to answer your need. Get in touch with your nearest Lindberg Field Representative (see classified phone book) or write direct to Lindberg Engineering Company, 2447 West Hubbard Street, Chicago 12, Illinois. Los Angeles plant: 11937 South Regentview Avenue, Downey, California. In Canada: Birleco-Lindberg, Ltd., Toronto.

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LINDBERG
heat for industry

New model 24 Lapmaster



new compact machine design...
more production lapping efficiency, yet takes less floor area... easy hand-wheel adjustment of conditioning rings to keep lap plate flat.

new, larger, adjustable work table...
wrap-around design for fast loading, unloading from almost any position... pneumatic lifts to facilitate work handling or to provide extra down pressure.

new abrasive distribution system...
pressure pump at constant head for uniform deposits at lapping stations... assures uniform cutting action to control the amount of stock removal... always maintains correct abrasive mixture... provides adjustable flow control.



Compound and vehicle distribution pump and tank swing out for filling ease, swing in, out of the way, during production.

Lapmaster
...THE
MACHINE THAT PUT
PRECISION LAPPING ON A
PRODUCTION BASIS

SEE THE NEW LAPMASTER AT BOOTH 550,
COLISEUM MACHINERY SHOW, CHICAGO,
SEPTEMBER 7-15. ALSO... REQUEST OUR
NEW CATALOG OF OTHER LAPMASTERS.

A product of

CRANE PACKING COMPANY

6469 Oakton Street, Morton Grove, Illinois (Chicago Suburb)

In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

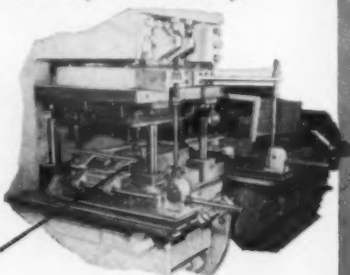
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TRANSFER UNIT

is the
right move
in your —

Die changeover is quickly made. Economical even for low volume production on new or existing equipment.

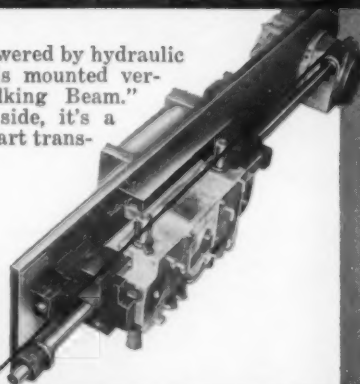
Automation with LIVERNOIS Standard Transfer Units are easily incorporated in new designs to fit large or small presses. Move any part, any distance vertically or horizontally.



Press application of small 3-station line transfer unit shown.

AUTOMATION

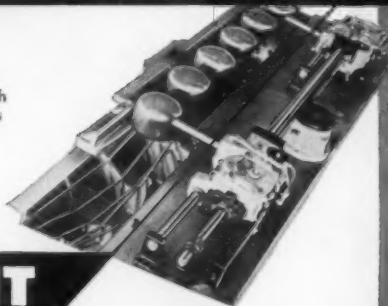
Standard unit powered by hydraulic or air cylinder is mounted vertically for "Walking Beam." Mounted on its side, it's a "Shuttle Type" part transfer unit.



There is a LIVERNOIS Transfer Unit available for most applications

TRANSFER

Patented—with
other Patents
Pending



UNIT

Large cup trimming shows the "BUILDING BLOCK" arrangement using hydraulic power. Write for 8 page illustrated brochure. Or, call Detroit Code 313 CR 8-0200.

LIVERNOIS ENGINEERING CO.
"The Moving Engineers of Automation"
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SPECIAL CUTTING Tools

They cut costs
because they cut
operations...
75% or more!

Custom-designed and precision-made exactly to fit your needs. Spiral Tools boost output and quality. Ask for details.

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END MILLS**
Quickly, Completely,
IN YOUR OWN SHOP

For grinding or milling of any spiral lead. Pays for itself in a hurry. Send for facts today.



**Super MULTI-SPIRAL
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Designers and Manufacturers of
All Types of Special Cutting Tools

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A Severance CARBIDE ECONO-SINK WILL GIVE YOU —

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- SMOOTHER SEATS
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- LESS DOWN-TIME
- AND A COMPLIMENT FROM THE BOSS FOR SUGGESTING THE CHANGE

Chatter-Free DESIGN
Solid CARBIDE CUTTING HEADS

MAKE THE Switch to Carbide BEFORE IT'S TOO LATE

WITH THE NEW Severance CARBIDE ECONO-SINK YOU GAIN ALL THE ADVANTAGES OF CARBIDE TOOLING — AND AT LESS COST per Countersunk Hole

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The Tool and Manufacturing Engineer

**STANDARD'S Carbide-tipped
Expandable Shell Chucking Reamer, with**

replaceable shells

**TAKES THE
COST OUT OF
CARBIDE
REAMERS!** *



*When the Carbide Tipped Shell has worn to its tolerance limit, it can be expanded to the original diameter by forcing the shell up the tapered arbor. The expansion feature is for wear compensation only.

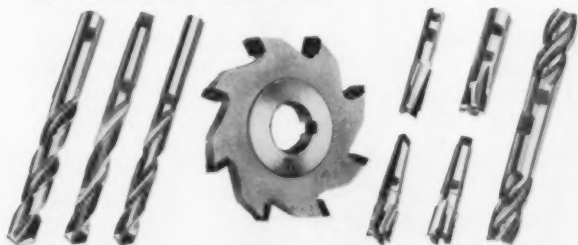
***WHEN SHELL HAS BEEN FULLY EXPANDED...JUST REPLACE IT!**
This eliminates the expense of buying complete new reamers. The replacement shell is provided with suitable grind stock, and can be finished to size after assembly.

*The Standard Shell Type Expansion Chucking Reamer is designed for low-cost, high-precision reaming. It is ideally suited for mass production of parts having close tolerance holes.

***STANDARD'S TECHNICAL HELP ALWAYS AVAILABLE!**

STANDARD'S Engineering Department welcomes queries about your reaming problems. It is possible that with this expert help you can realize greater savings and higher production of parts calling for close tolerances.

CALL the STANDARD Man in your area, he will show you **STANDARD'S** complete line of **SOLID and CARBIDE TIPPED** Quality Cutting Tools.



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Authorized Distributors
Stock-ready for immediate
delivery—the **COMPLETE**
FAMILY OF STANDARD
QUALITY CUTTING TOOLS,
Twist Drills...Reamers...Taps...
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...Counterbores...Hobs...Carbide
Tools and Gages.

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The most efficient
compressed-air-line filter
you can buy...



Type 30BE

New, perfected-design
Norgren Air-Line Filters
give you these benefits:

1. Complete liquid removal.
2. Highly effective removal of solids.
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4. New, stronger transparent bowl.
5. Larger bowl capacity and larger quiet zone for trapping collected liquid.
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7. Quick, easy cleaning—no tools needed—only 4 parts to handle.



Where safety regulations
require protection for
bowls from external physical
damage—a removable metal
bowl guard is available.

Founded in 1926

C. A. NORGREN CO.

3447 SOUTH ELATI STREET
ENGLEWOOD, COLORADO

Norgren Filter removes all liquid from compressed air

The improved design of the new line of Norgren Filters provides a greater than ever liquid removal efficiency—removing all liquids over the entire range of recommended air flow. Removal of abrasive solid particles is also highly effective.

New, stronger transparent bowl is an important feature of the new filters. This bowl has a higher safety factor than ever before and a much greater resistance to fatigue.

The bowl has a larger capacity for collected liquid. The "quiet zone" below the baffle holds 53% more collected air-line contaminants—requires less frequent draining.

Servicing is easier and quicker. No tools are required to disassemble the filter for cleaning, and there are only four separate parts to handle.

For complete information about the money-saving features of the Norgren complete line of manual drain and automatic-drain filters, call your nearby Norgren Representative, listed in your telephone directory—or WRITE FOR BROCHURE NA-1.

NEW TOOL STEEL SERVICE

reduces
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costs



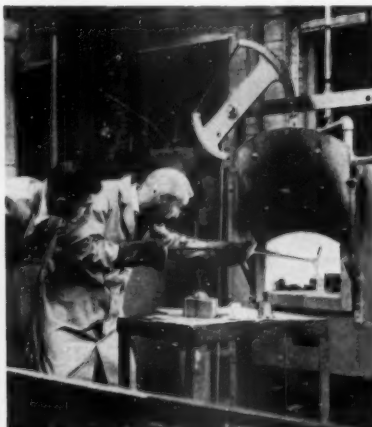
The man who heat treats many different tools



can realize major savings with Crucible's new Tool Steel Service.



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He'll know exactly how each grade responds to heat treating.



—so he'll certainly get more consistent results by employing time-tested techniques.



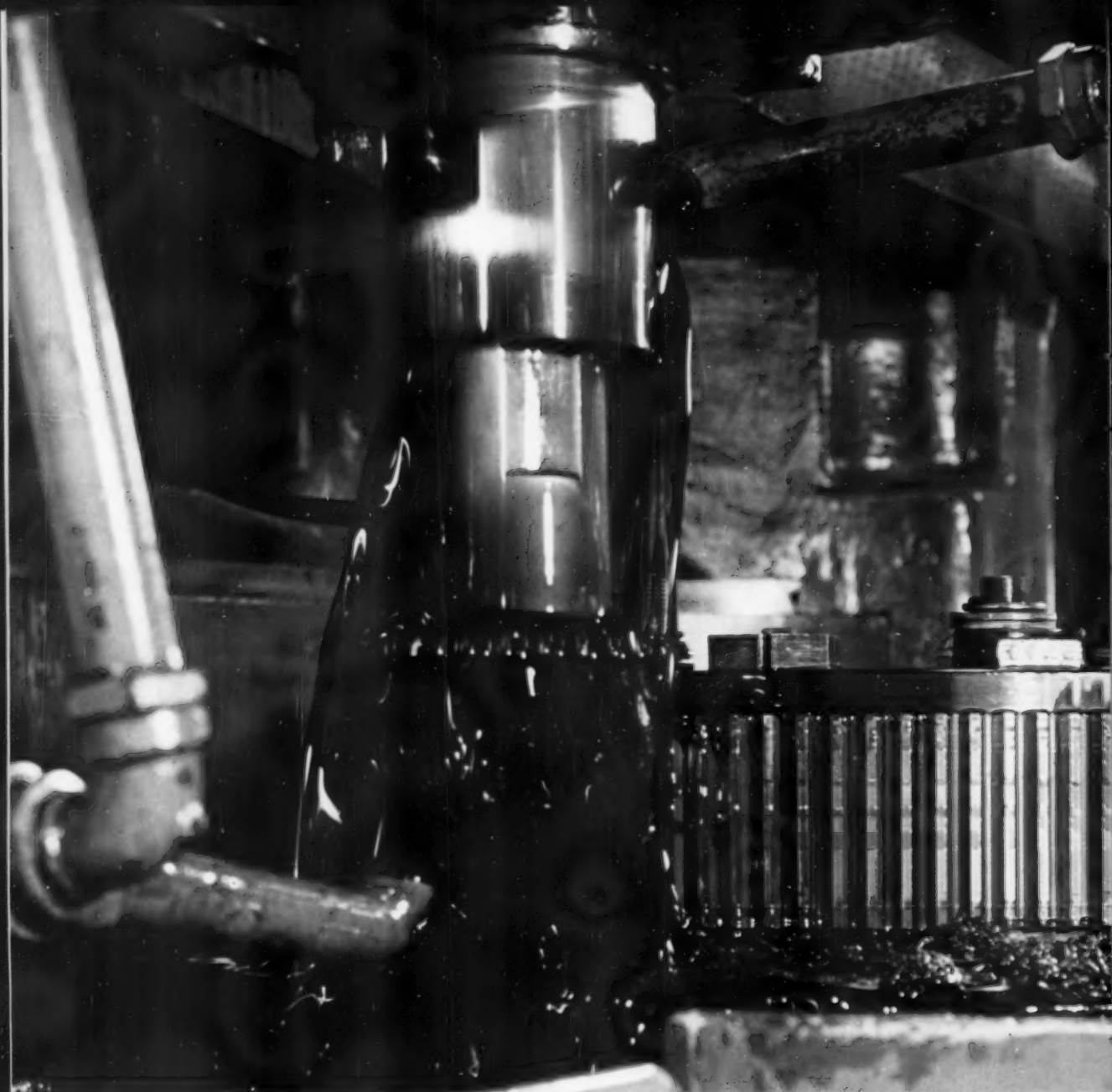
All by standardizing on a few basic tool steel grades!

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Switch to Gulfcut® oil doubles tool life for **GULF MAKES THINGS**

Gang-cutting 120 teeth in stacks of 50 clutch discs made of SAE 1035 steel, .090-in. thick, to tolerances of .0033" at relatively high feeds and speeds is rough on cutting tools. But Gulfcut 21C oil makes it just half as rough at American Brakeblok Division of American Brake Shoe Company, Cleveland, Ohio.

Says Edward Salamon, Product Engineer, "As the cutting tool on the Fellows Gear Shaper enters each disc,

there is an impact, generating additional heat and increasing the tendency for the tool to chip. With the machine making 86 strokes a minute tool life used to be rather short. Since changing our cutting oil to Gulfcut 21C we've achieved two benefits: we've doubled our tool life, and we've rid the operation of the very unpleasant odor of the previous oil."

"The substantial increase in tool life and over-all oper-



Wally Pavlak, Foreman, left, shows Thomas F. Irving, Gulf Sales Engineer, that tolerances of .0033" have been maintained with help of Gulfcut 21C.

◀ Changing to Gulfcut 21C has doubled tool life in this Fellows Gear Shaper, here cutting a stack of 50 clutch discs, each .090-in. thick.

American Brakeblok . . . **RUN BETTER!**

ating efficiency," says Mr. Salamon, "has shown us that we don't need to be cutting oil specialists. We just call in a Gulf Engineer to provide the answers."

See for yourself how Gulf makes things run better! A call to your nearest Gulf office will bring a Gulf Sales Engineer with practical help. Meanwhile, send for your free copy of "Metal Machining with Cutting Fluids," the new 116-page handbook on their selection and use.

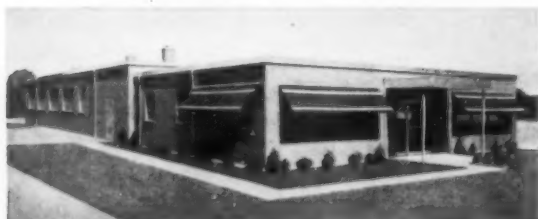
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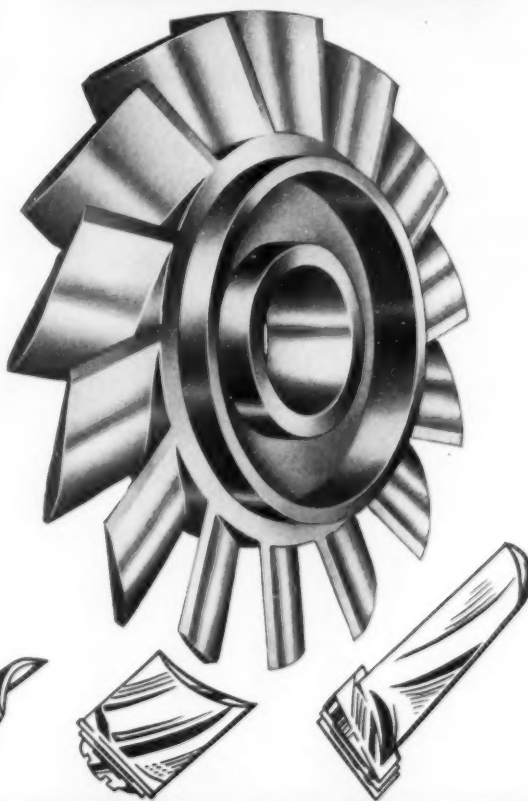
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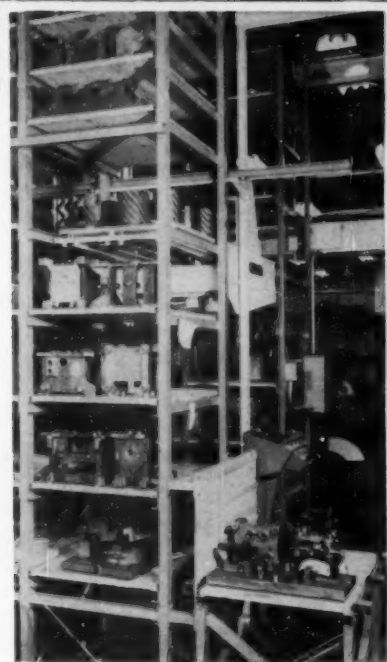
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The Tool and Manufacturing Engineer

BURSTING AT THE SEAMS!

INSTALL AN R-46 FINGERTIP CONTROL TOOL CRIB



SAVE 70% ON SPACE . . . 30% ON LABOR!

In this new R-46 *Retriever*® installation at the New Philadelphia, Ohio, plant of the Warner and Swasey Co., many factors were of prime consideration.

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*F.O.B. Euclid, Ohio

This simple, push-key console controls the unique two-way *Retriever*®. The keys on the left set the *Retriever* to deliver an incoming load into the desired opening. Setting the right-hand panel will direct the *Retriever* to bring back any other load on the return trip.



THE TRIAX COMPANY

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September 1960

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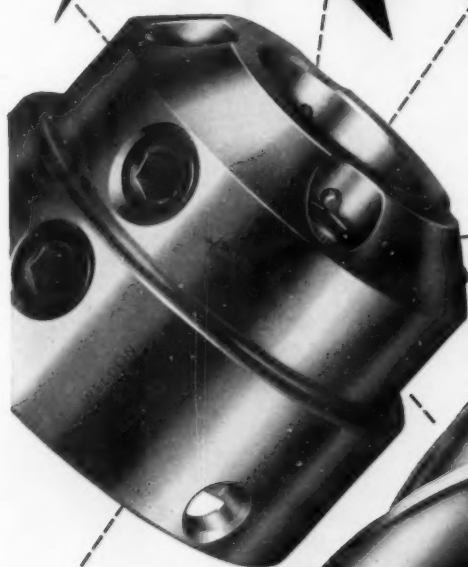
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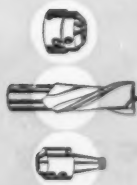
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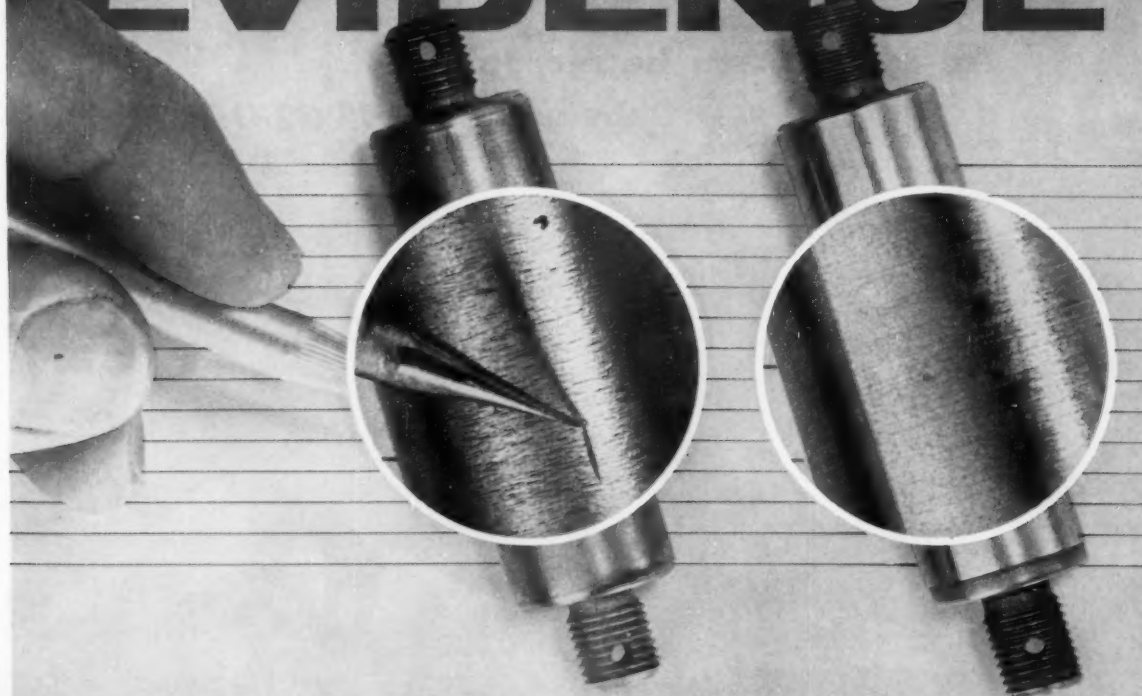
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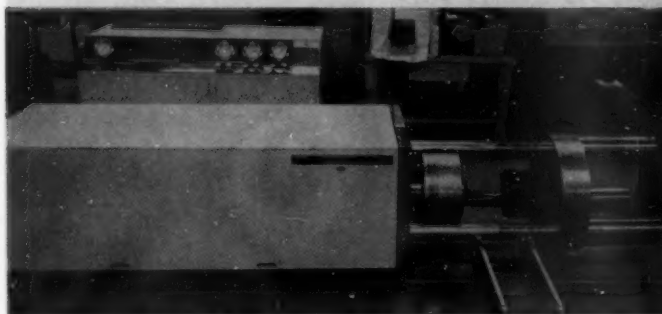
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EVIDENCE



►► Here is clear evidence that high velocity extrusion of metal has dispersed stringy non-metallic inclusions. The part pictured is a hinge pin for USAF's B-58 Hustler. The pin on the left was machined from AISI 4335 modified bar stock. The clearly visible inclusions made the part unfit for service. The pin at the right is made from the same material, but only after it had been extruded at very high velocities by a DYNAPAK machine. The inclusions have been eliminated. The part is completely satisfactory. There is no need to change to a more costly metal, or to resort to special mill heats.



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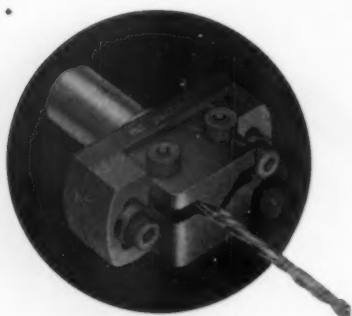
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ANY IDEA which can cut welding time from 90 to 45 minutes on missile beams for the Army is darned important! That's exactly what happened in a New Jersey plant. A LINCOLN Field Engineer was walking through the plant with the Welding Foreman and Plant Manager. Naturally he was interested in watching the welding operation on missile beams. A thought crossed his mind. He asked if he could demonstrate LINCOLN Jetweld electrodes on the beams. He rolled up his sleeves; took some Jetweld from the trunk of his car, and cut the welding time from 90 to 45 minutes. The weldors on the job did the same. That afternoon the Field Engineer finished his plant tour and spotted some applications for Fleetweld 37 electrodes for welding sheet metal on trailer bodies. Again welding time was cut almost in half, cleaning time reduced and overall costs slashed to the bone. Quite a day's work for one Field Engineer . . . but putting PROFIT into welding operations is part of each LINCOLN man's job. You can count on him to show you . . . not tell you how to cut costs and make more money. That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge. Call your LINCOLN Field Engineer today.

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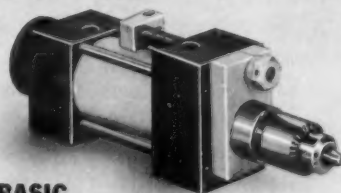
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The Tool and Manufacturing Engineer

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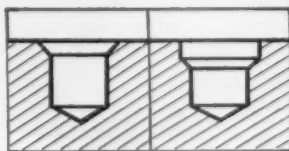
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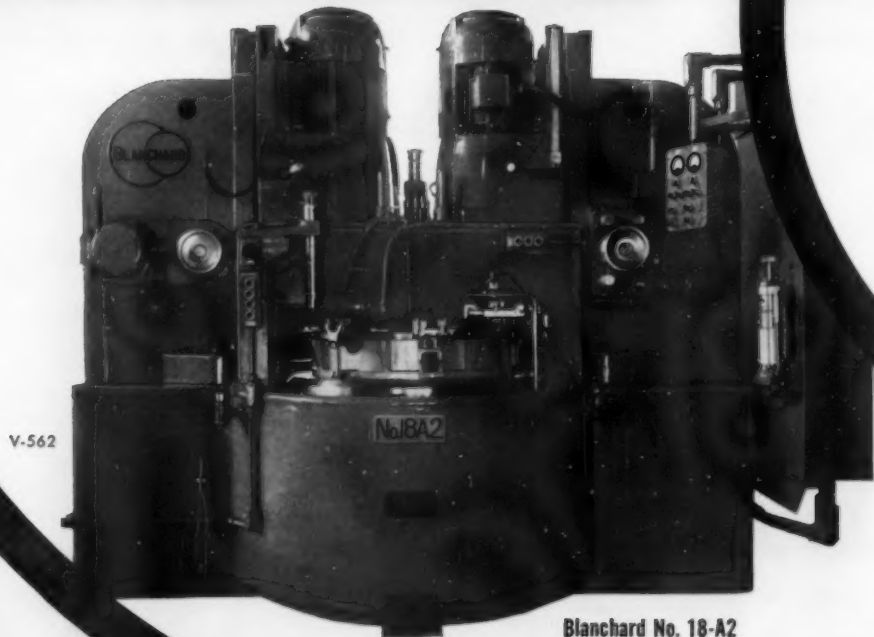


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No. 27-48 Blanchard Surface Grinder

V-561



V-562

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Two-Spindle Automatic Surface Grinder

if grinding efficiency
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DON'T MISS SEEING THESE NEW BLANCHARDS AT CHICAGO!

Two entirely new Blanchard Grinders of advanced design will be introduced at the NMTBA Exposition in Chicago. Both machines offer new features and high production capabilities that will interest everyone whose operation requires high-speed, precision grinding.

Booth No. 1209



The Blanchard Machine Company

64 State Street, Cambridge 39, Mass.

September 1960

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The No. 27-48 Blanchard Surface Grinder is an entirely new size of Blanchard Grinder. This machine will be equipped with hardened base ways, will be of "dry base" design, and will have a conveyor-type sludge tank mounted at the rear. This machine has a 48" diameter magnetic chuck with a clearance of 52" inside of the waterguards, 12" vertical range and a 27" segment grinding wheel. This grinder has a 75 HP main spindle motor. Coolant is directed both to the inside and outside of the grinding wheel. These features provide ample power, rigidity and coolant flow for heavy stock removal on a large variety of work pieces. This machine affords great accuracy, extreme flatness and fine finish.

This grinder will be equipped with a motorized Single Cut Device and a floor-mounted control panel.

Other features include: a hand-operated Trabon lubrication system for the spindle bearings, wheel dresser and head ways; automatic Bijur lubricator for the hardened base ways; and oil reservoirs for the table bearing and chuck rotation units.

The No. 18-A2 Blanchard Surface Grinder is a new Two-Spindle Automatic Surface Grinder. This new grinder is of a "dry base" design: in operation all coolant and chips flow to an outside settling tank or central coolant system. The design provides easy access to the grinding wheel area. Push button stations and operator's control are conveniently located for ease of set-up. All controls are interlocked to assure complete safety. A warning light flashes at the operator's station when grinding wheels require replacement. The grinder is equipped with 30 HP foot-type spindle motors.

The grinder has a plain table for mounting of special work-holding fixtures, and a six-speed gear box for table rotation, with provision for locking this in a pre-selected speed. The feed rate in thousandths of an inch per minute can also be locked. The grinder at the Exposition will have an eight-station fixture, each station handling a different work piece to demonstrate the ingenuity of Blanchard fixture design. This table will be rotating to demonstrate clamping and unclamping of the fixtures, and to show the path of the work pieces through the grinding wheels and under the wheel control calipers.



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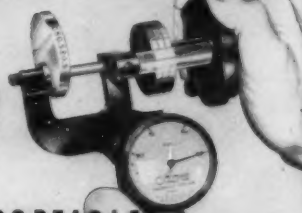
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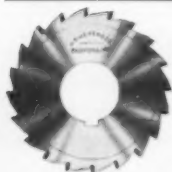
Besides testing flats, rounds, tubing, etc., Ames Hardness Testers make tests that otherwise would be impossible, such as large gears, knives, saws, blades, struts, frames and assembled parts. Thousands are in use paying for themselves over and over again in time and materials saved.

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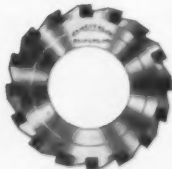


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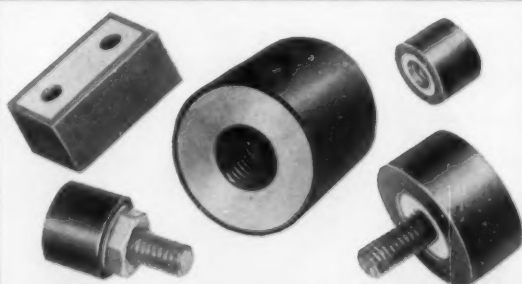
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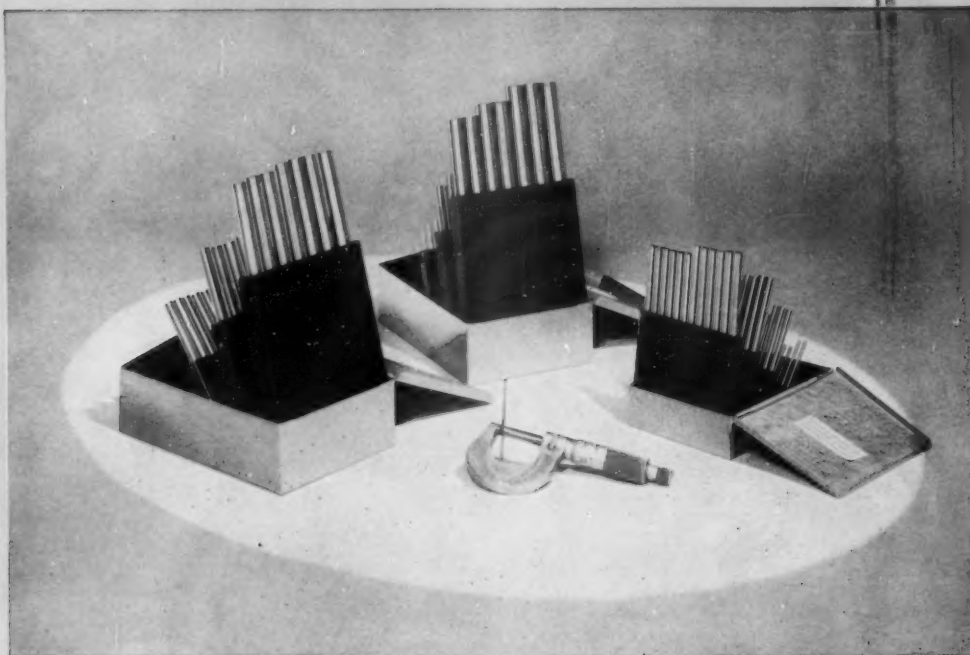
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The Tool and Manufacturing Engineer

WILLIAM T. HUTCHINSON CO.

53 BROWN AVENUE

SPRINGFIELD, NEW JERSEY

HUTCHINSON HSS BLANKS**115 Pieces — COMPLETE — .040" to .500" — \$88.00**

your choice of two tolerances

+ .0002" — .0000

or

+ .0000 — .0002"

JOBBER SET	LETTER SET	WIRE SET
\$32.27	\$29.03	\$27.40
in Huot Index	in Huot Index	in Huot Index

HIGH SPEED STEEL — 64 "C" scale hard — gage tolerance — mirror finish — parallel ground.

ANY DECIMAL DIAMETER OF STANDARD LENGTH
.010" TO 1.000" SHIPPED ON 24 HOUR NOTICE

DOW**NOW IN MAGNESIUM AND ALUMINUM**

10¢ PHONE CALL CUT MACHINING TIME 50% ON 3-FT. INDEX TABLE!

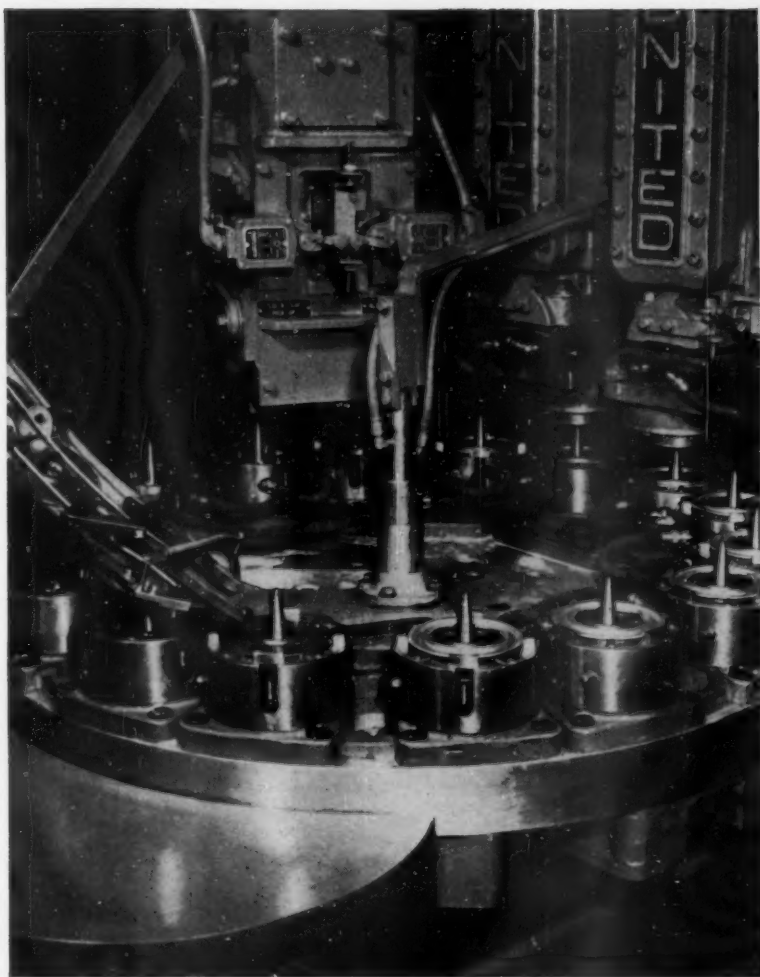
Ordered-by-phone magnesium tooling plate disc replaced cast steel index table for machinery manufacturer . . . "as purchased" flatness cut previous machining time on this part in half . . . saved 50% on machining costs.

United Welders Inc., of Bay City, Michigan, recently replaced steel with magnesium tooling plate in making the precision index table, or dial, for their automatic 8 Station Dual Dial Welder. This machine is used in welding the bottom gasket retainer for an oil filter assembly in 1960 automobiles.

The dials previously were made of

cast steel which required costly, time-consuming surface and edge machining to finish. The 2½ inch by 36 inch dials of magnesium tooling plate are now purchased rough-cut to size from the local Dow magnesium distributor, and are finished by simply edge truing and drilling. Because the as-purchased flatness completely eliminates need for surface

machining, United's machining costs on this part have been cut by more than half. Production has been speeded, too, because magnesium's light weight makes the dials easy to handle during manufacture. Two men can easily lift and handle the light disc. Cranes or lift trucks aren't needed as they were with the previous steel dials.



LIGHTNESS CUTS POWER NEEDS 75%

In the United welder above, the dial starts and stops 500 times per hour during welding operations. This lightweight magnesium dial requires only a quarter of the power needed to operate the previous steel dial. It permits a drastic reduction in the cost and size of motor, speed reducer and other necessary driving elements.

**RIGIDITY MEANS
ACCURATE POSITIONING**
United Welders employs a Geneva

Stop Movement to position parts accurately under dual automatic spot welding heads. Magnesium's rigidity helps the dial retain close tolerances necessary for continued accuracy.

Magnesium tooling plate has other advantages, too. It costs less to buy than other lightweight tooling materials and can easily be welded. It can often be obtained ready-cut-to-shape from distributors, saving additional time in your shop.

THE DOW METAL PRODUCTS COMPANY, Midland, Michigan

DIVISION OF THE DOW CHEMICAL COMPANY



Because magnesium tooling plate is uniformly flat, it can be used for almost all tooling jobs without surface machining. It's rolled and thermal flattened to close flatness tolerances . . . high dimensional stability keeps it flat in use.

MAGNESIUM TOOLING PLATE IS AVAILABLE FROM STOCK AT:

Clendenin Bros., Inc.
Baltimore, Maryland

Copper and Brass Sales, Inc.
Cleveland, Ohio; Detroit 12, Michigan

Fullerton Steel and Wire Company
Chicago 35, Illinois

Hubbell Metals Inc.
St. Louis 3, Mo.; Kansas City, Mo.;
Marietta, Ga.

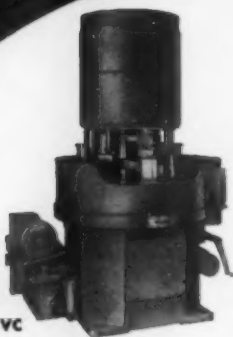
A. R. Purdy Co., Inc.
Lyndhurst, New Jersey

Reliance Magnesium Company
Los Angeles 58, California

Joseph T. Ryerson & Son, Inc.
Dallas, Texas

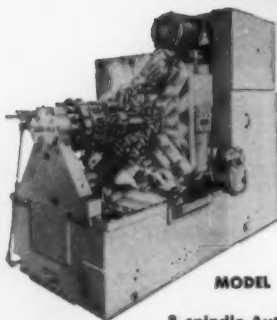


There's a wealth of information in Dow's new magnesium tooling plate manual. This handy 56-page book is filled with facts about shop working characteristics, machining, etc. For a copy, contact your Dow branch office or write to THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1033FJ9.



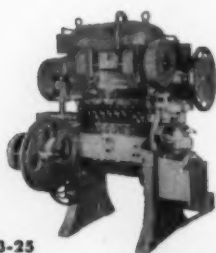
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Vertical Continuous Lathe
Remarkable New Improvements!



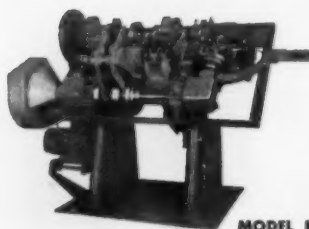
MODEL 78-H

**8-spindle Automatic Multiple
Chuckling Machine**
Important New Changes!



MODEL 3-25

Transfer Press for the High Production of Stamped and Drawn Parts
Many New Features!



MODEL RWI-1

Ribbon and Wire Inclined Forming Machine
All New!

MACHINE TOOL EXPOSITION PREVIEW

**BETTER STOP AT BAIRD
BOOTH 1142**

Your visit to the Machine Tool Builders' Show will not be complete if you miss the opportunity of seeing these 4 Baird high production performers in actual operation. The just-introduced RWI-1 represents the most startling innovation in ribbon and wire forming machinery in years ... important new design changes highlight the well-known Baird Transfer Presses, Chuckers and Vertical Continuous Lathes. We have a few surprises waiting for you, too!

BAIRD

THE BAIRD MACHINE COMPANY • Stratford, Conn.
Builders of High Production Machinery since 1848

Screw machine job shop
standardizing on 5-Chaser Vers-O-Tools ...

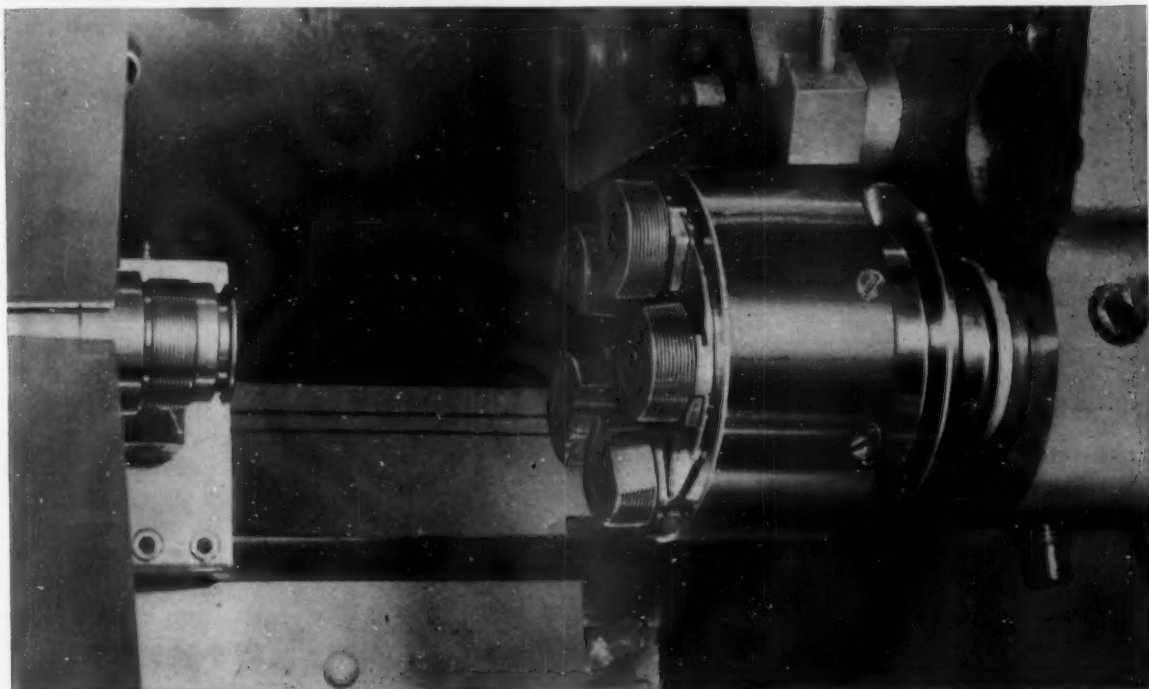


Two precision parts for hydraulic devices threaded with 5-Chaser Vers-O-Tool. Both have pitch diameter tolerances of .0045" (class 3 threads).

"The only economical way to meet tough threading specs"

"Extremely high threading tolerances have become the rule rather than the exception on most of our jobs," states Henry Libicki, Chief Engineer, U. S. Automatic Corp., Amherst, Ohio. "We're convinced the only economical way to meet these increasingly tough specifications is with National Acme 5-Chaser Vers-O-Tools. In every instance, they give us far more accurate threads than 4-chaser tools . . . have helped us keep pace with our customers' requirements and attracted more profitable business. We've started a change-

over program to 5-Chaser Vers-O-Tools. It's a vital step in the constant improvement of our operation." Enthusiastic comments like these sum up the feelings of hundreds of users of NAMCO 5-Chaser Vers-O-Tools. In your plant they'll give more pieces per grind, highest threading accuracy, and the economies of greatly reduced set-up time. NAMCO 5-Chaser Vers-O-Tools are available *from stock* in a *complete* range of sizes. Get all the details. Contact your local National Acme Sales Engineer, or write for Bulletin DV-1.



5-Chaser Vers-O-Tool was easily installed on existing single-spindle machine. A tripping mechanism using a solenoid and a micro switch attached to the Vers-O-Tool provides automatic control of die-head trip-off to within .002" to .003" at shoulder. (Developed at U.S. Automatic Corporation.)



National Acme

The National
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Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

SEE IT AT CHICAGO



Modumatic Systems Control-Display

MEASUREMENT • POSITION • INSPECTION



Norden Division of United Aircraft Corporation presents advanced but simple systems applicable to your need for faster, more accurate positioning of tool or workpiece

Norden Modumatic Systems feature readout of actual position, automatic positioning, full range origin select, and controlled programming

FOR MEASUREMENT

Series 100—This system displays in straight decimal form the exact position of the tool or workpiece. One display is used for each axis of motion.

Features—Illuminated numbers, readable from twenty feet—individual plug-in decimal units—display unit can be located on machine or remote.

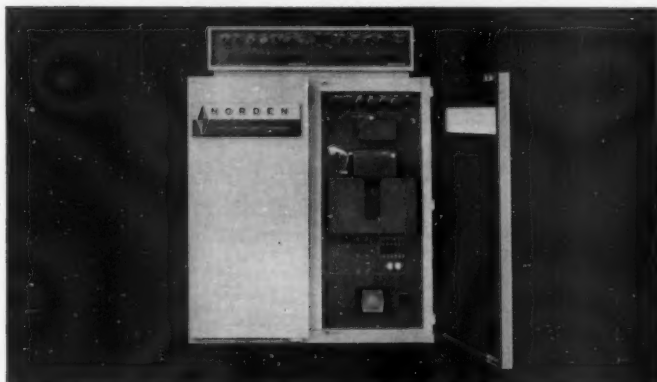
FOR POSITIONING

Series 600—A completely automatic positioning system with input from either manual dial-in switches or punched tape. Display units provide decimal readout of actual position—not command.

FOR INSPECTION

This new Norden concept now makes possible automatic inspection of parts by measuring their exact shape and contour. Since each point on the part's surface has a digital value this information can be easily programmed. Corresponding points on the actual part can be probed automatically and their dimensions compared with the programmed information. The system can be provided with direct numeric print or readout of actual dimensions, deviations from nominal, or out of tolerance indications. In addition, punched tape output is available.

Norden numerical control systems also offer full range electronic origin select. This allows any desired offset to be quickly and easily dialed in by the operator on manual selector switches. In addition, these systems are available with automatic tape punch units for tape preparation "on the machine." This provides a permanent inspection record or a programmed tape for playback applications.



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for the*

**PRODUCTION ENGINEERING SHOW,
NAVY PIER SEE US AT BOOTH 221.**
At the National Machine Tool Builders
Show see Norden Controlled Machines
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1350. Atlantic Machine Tool Works,
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For more information contact your nearest Norden Representative. 400 Main Street, E. Hartford, Connecticut, JAcson 8-4811. 11 West Monument Avenue, Dayton 2, Ohio, BAldwin 8-4481, or write us at the address below.

OF UNITED AIRCRAFT CORPORATION
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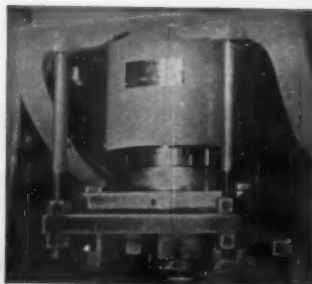
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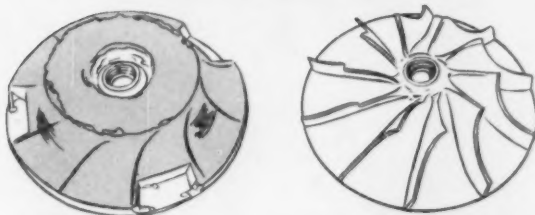
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The Tool and Manufacturing Engineer

CERROTECHNICS

saves TIME • LABOR • MONEY

in machining turbine rotors



(CERROTECHNICS is the practice of using low-temperature-melting CERRO® ALLOYS to expedite many industrial operations).

Here we show how an aircraft manufacturer supports the thin blades of a turbine rotor in CERROBEND® ALLOY to prevent distortion in machining. After machining, the matrix alloy is melted away at 158°F.



Send for bulletin listing the 63 CERRO ALLOY applications.

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New Way To Check
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WITH THE O-VEE THREAD GAGE

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O-VEE Gages are available for all std sizes from .05 to 1" — All series — All class fit. Special sizes available from 1/8" up to and including 5"

O-VEE COMPARATOR

Based upon the same principle and using interchangeable coils, this comparator gives a visual reading within any pre-set tolerance range. Available in 3 models.

ASK FOR ILLUSTRATED FOLDER



Model # 2

Range
1/8" to 1-1/4"
8 to 32 T.P.I.



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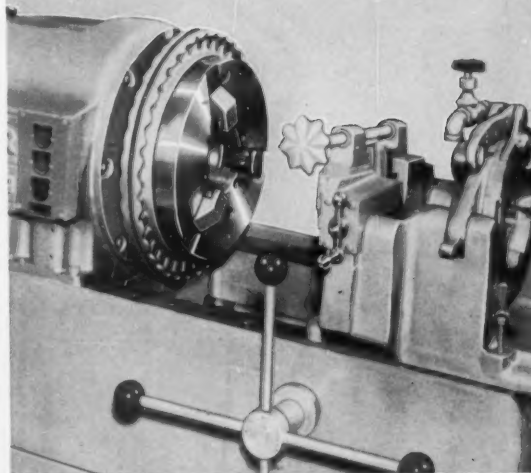
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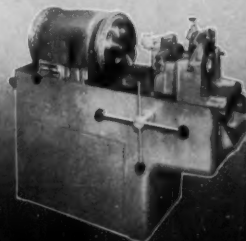
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Vertical Millers, 1-6

WERNER

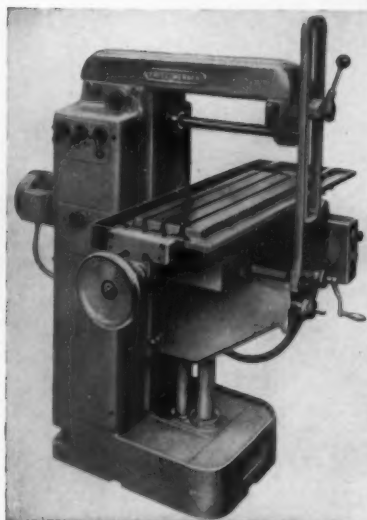
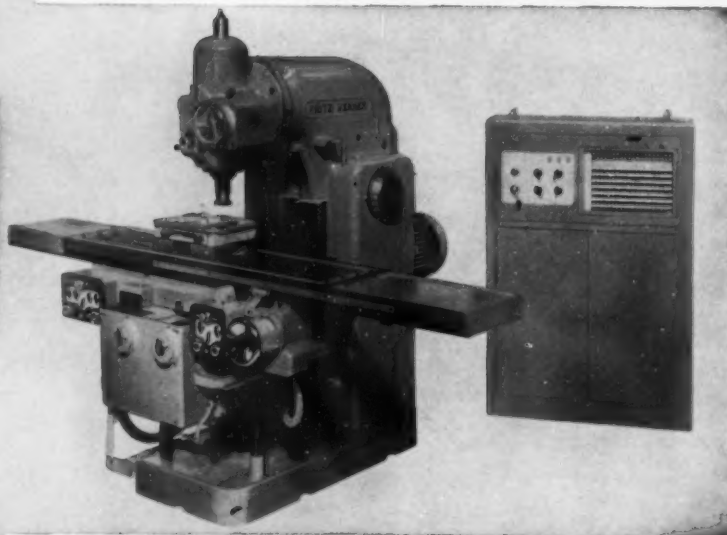
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Ask for Free Admission Ticket on your firm's letterhead



Fritz Werner automated, three-dimensional program-milling saves 40% to 75% over conventional vertical or horizontal milling. The Werner method is simple and easy to maintain. Investment is comparatively low, and in addition, the machine can still be used over its full range for either automated or conventional milling.

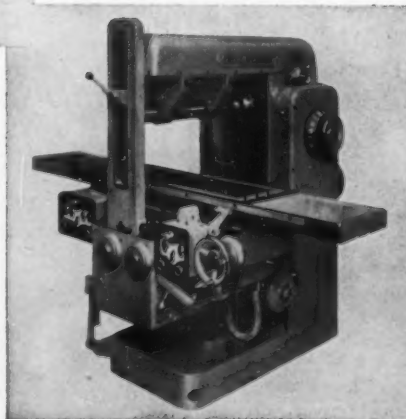
Production Millers, 0-4

Send for illustrated booklet describing FRITZ WERNER program-controlled milling, and how it can pay you dividends on both long- and short-run milling jobs.

MARAC

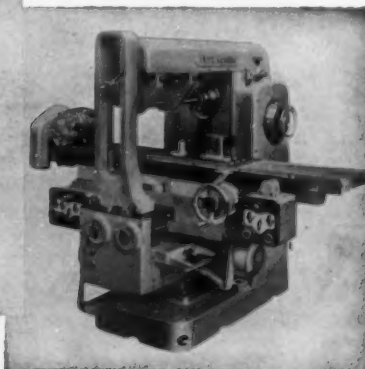
MACHINERY CORPORATION

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White Plains, New York



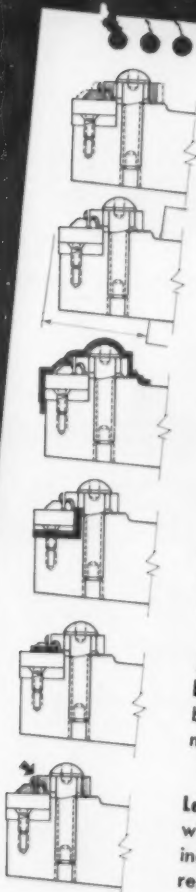
Left: Plain Millers, 1-6

Below: Universal Millers, 1-4



PRODUCTION RELIABILITY YOU CAN COUNT ON!

**THAT'S WHAT YOU GET WITH
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... AND HERE'S WHY:**



Fully adjustable chipbreaker for complete chip control—A Valenite first, with five year record of dependable on-the-job performance.

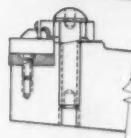
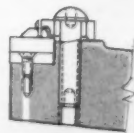
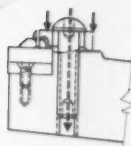
Shortest overhang—More tool in the tool post means greater rigidity.

Lowest profile—Insures maximum chip clearance even in close quarters.

More accurate pocket—Special machining to rigid quality standards guarantees full insert support and fast, accurate indexing.

Area clamping contact, chipbreaker-to-insert—Prevents breakage from chip wedging, minimizes insert stress.

Lock-pinned chipbreaker—Stays with clamp when changing or indexing inserts, yet is fully replaceable.



Convenient, damage-proof clamp screw—Axial, straight line load design prevents clamp screw damage. Clamp screw is adjustable from top or bottom.

Cadmium plated, hardened tool steel shank—Rugged, rigid, and corrosion proof.

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The Valenite Holder is ready right now with time and job proven advantages for faster, more trouble-free production — a better product at less cost.

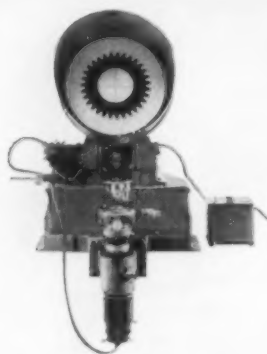


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METALS**

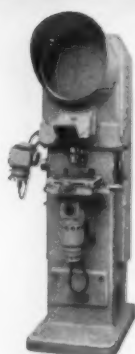
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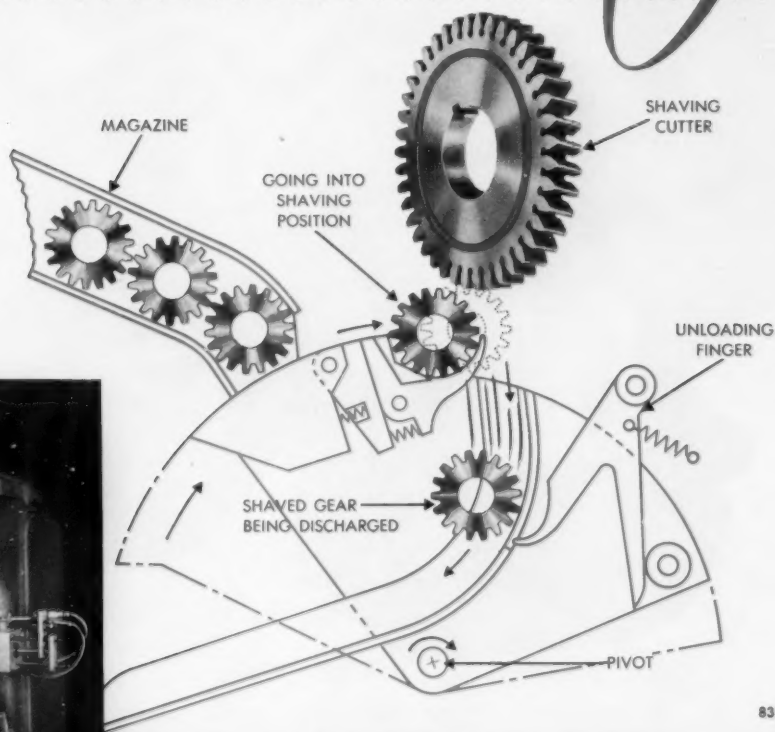
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Production you can expect from automated gear shaving is determined by the type of automatic loader you use.

You get maximum production when the loader moves a gear from the magazine into shaving position and discharges its shaved predecessor — **all at the same time**. This assures maximum cutter operation.

If, on the other hand, the loading of a fresh gear has to wait until the previous gear has been discharged, shaving is delayed and you get only about 75% of the production you could otherwise expect.

The standard Universal Red Ring Gear Shaving

Machine may be automated for **MAXIMUM PRODUCTION** — and without any major revisions in its design. Write for details.



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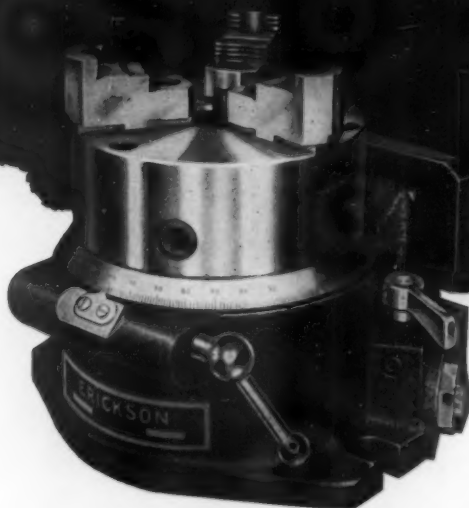
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ERICKSON MASTER SPACER

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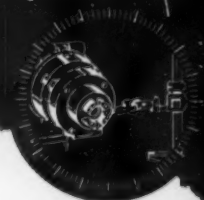


milling



*jig drilling
with either micrometer
or "Jo" block setting*

inspection

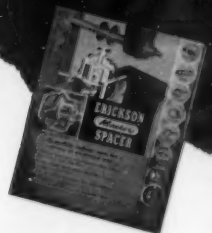


The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This one tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle. Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

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for all Erickson
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AA-0001

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WESTERN TOOL SHOW and ENGINEERING CONFERENCE

November 14-18, 1960

Los Angeles Sports Arena

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TOOL SHOW and ENGINEERING CONFERENCE

May 22-26, 1961

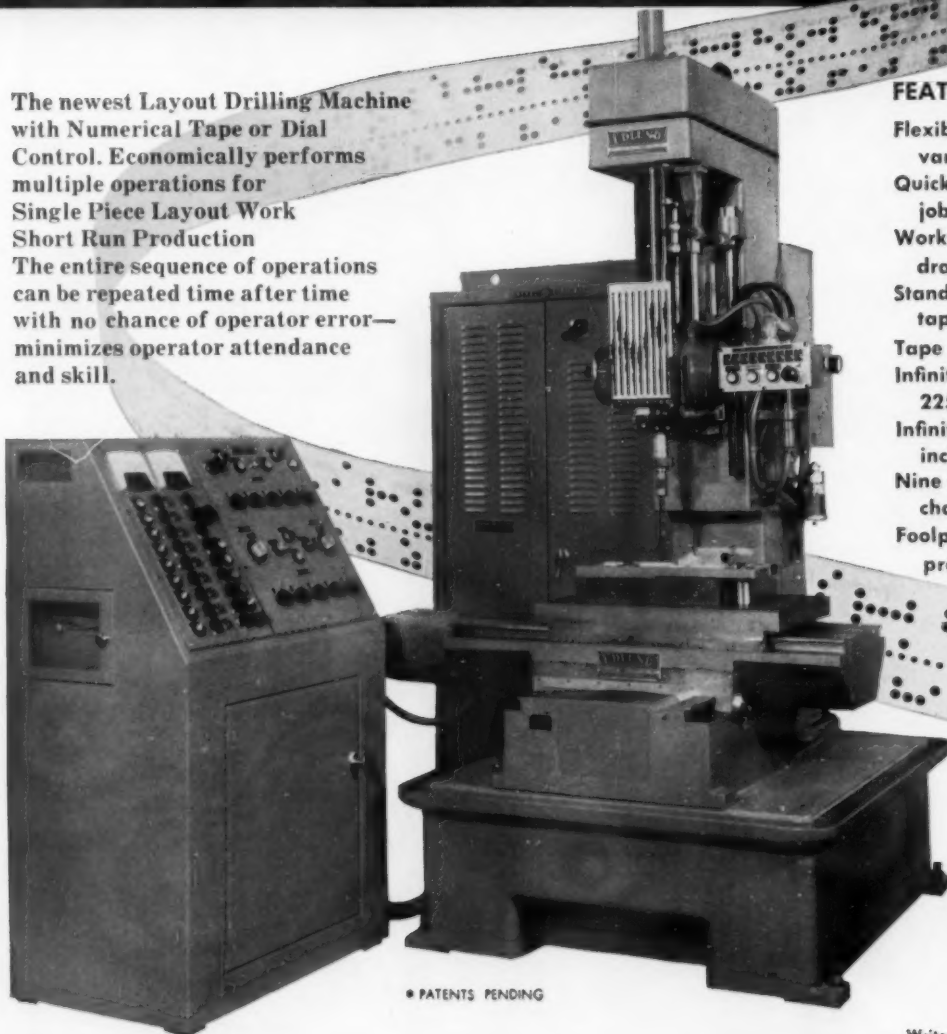
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For further information contact

**AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS
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FEATURES

- Flexibility in setting up a wide variety of operations.
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- Work from standard detailed drawings.
- Standard 1" 8 channel punched tape.
- Tape or Dial control.
- Infinitely variable spindle speeds 225-2700 rpm.
- Infinitely variable feeds 1 to 7 inches per minute.
- Nine different operations or tool changes at one setting.
- Foolproof tool rack (available) prevents use of incorrect tool.

See this new Edlund machine at the National Machine Tool Exposition SPACE 531

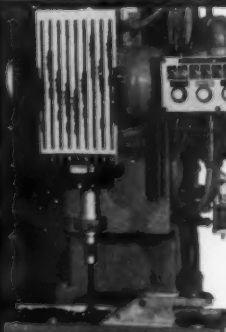
* PATENTS PENDING

Write for Bulletin 200.



CONTROL CONSOLE

Operation Selector Switch and Lights for nine operations. Spindle Speed and Feed Setting Knobs and Tachometers. Table Positioning Dials for two axes. Zero Offset Dials.



RAPID ADVANCE AND FEED STOPS PLUS PENDANT PUSH BUTTON STATION

At convenient eye level for precision setting and easy control. Indicator Lights designate operations.

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A new concept in extremely rapid positioning table. Many exceptional features. Table Travel 14" x 20". 200"/per min.



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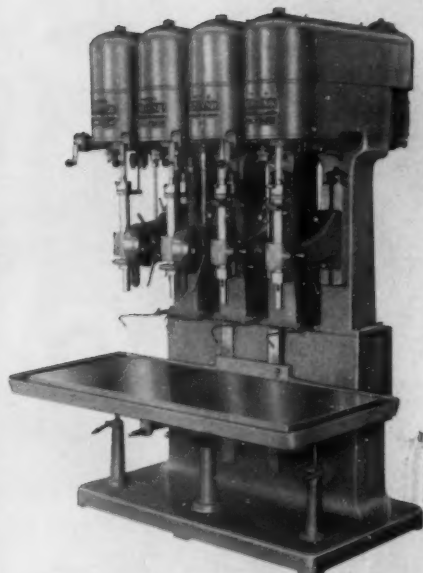
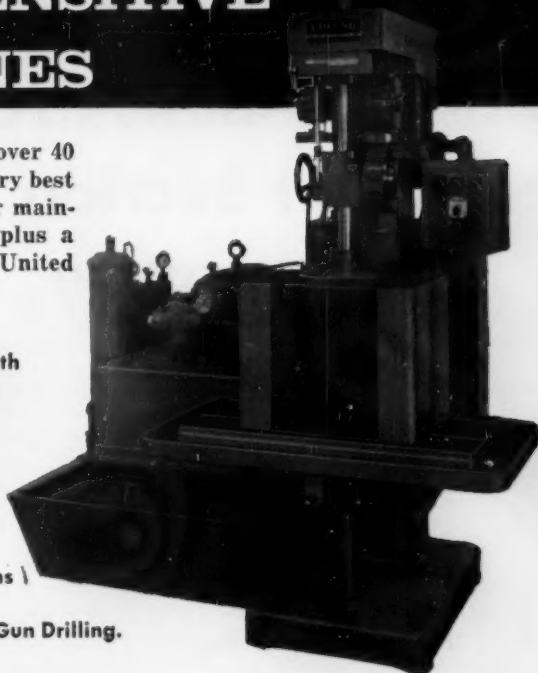
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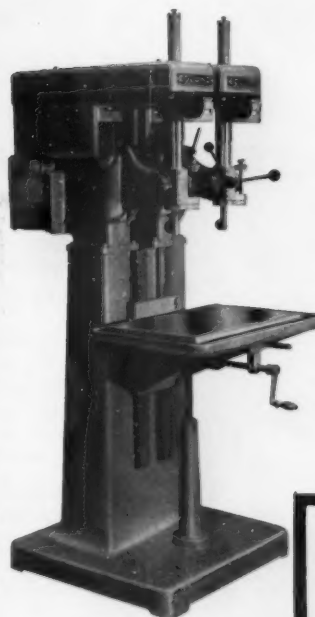
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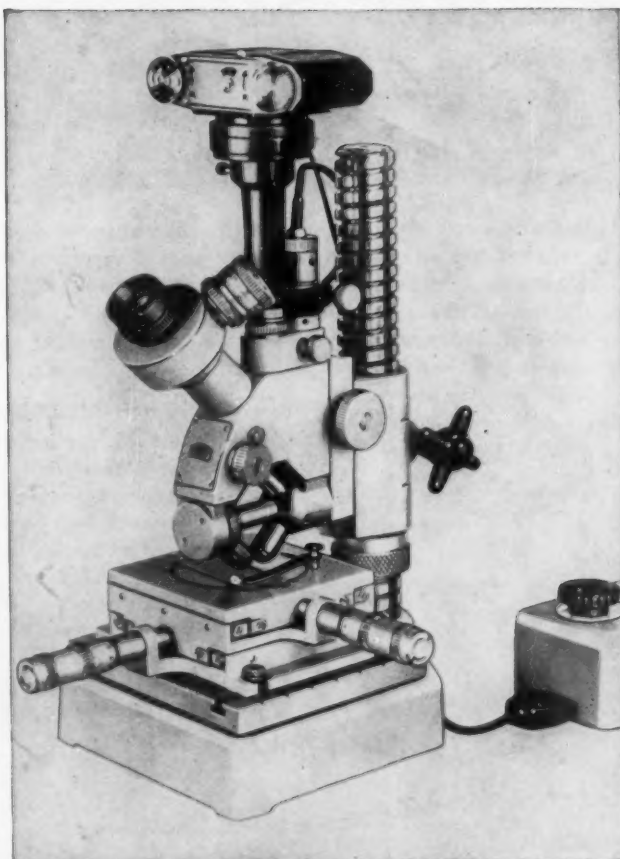
Light Section Microscope

This microscope produces a profile of the surface being examined by the well known light-section method. Roughness depth, as well as the groove distances of machine-finished surfaces, can be measured. Internal surfaces can be examined by making lacquer replicas.

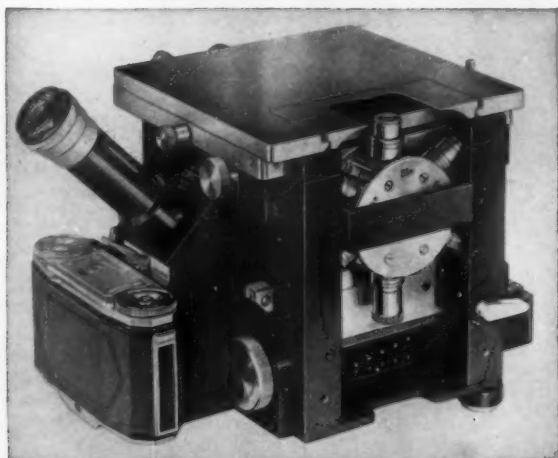
The newly developed revolving nose-piece for the objectives makes it possible to quickly change the magnification (height of profile) between 400x and 200x. At 400x, depths of roughness of 40 to 160 micro inches can be measured; at 200x, those of 120 to 4,000 micro inches.

Photographs for comparison and control purposes can be taken by mounting a 35mm miniature camera at top of the instrument.

In addition to the stage plate of the stand, a mechanical stage and center cradle (for turned parts) are available.



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for measuring minute depths of roughness
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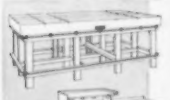


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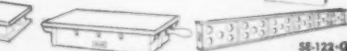
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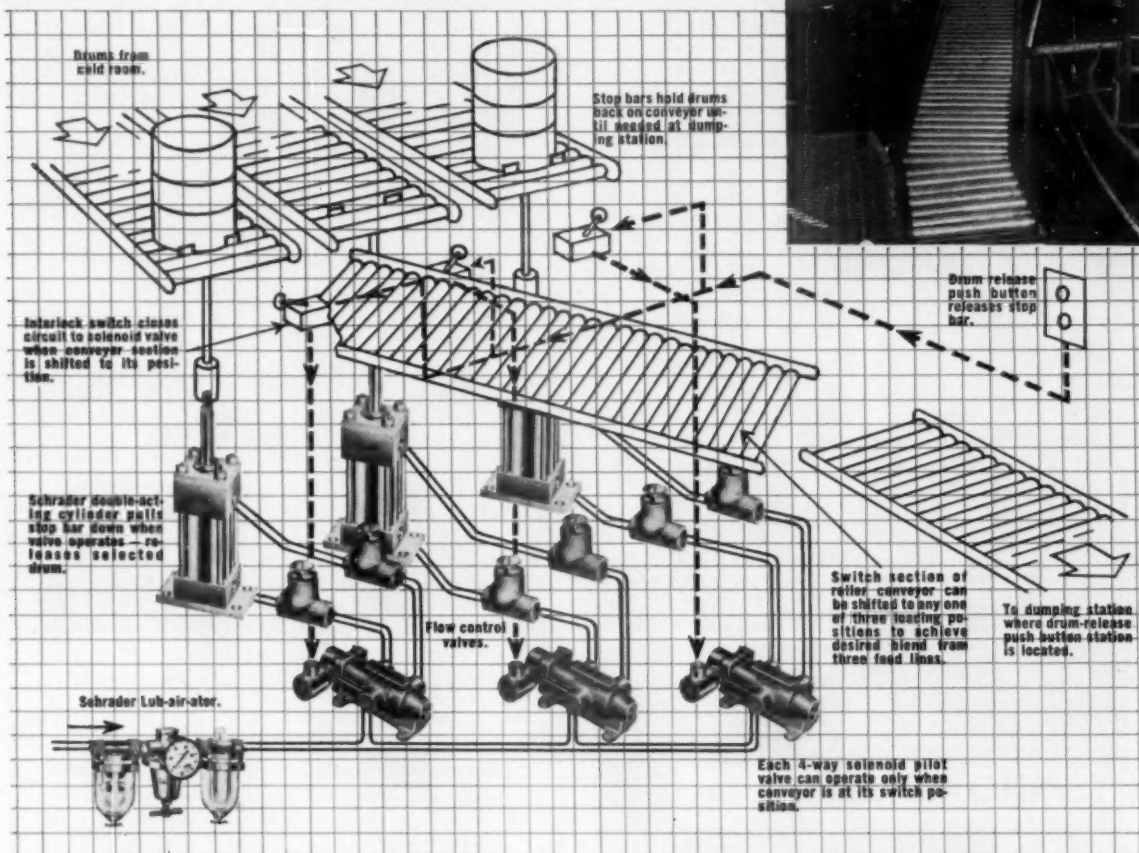
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The Tool and Manufacturing Engineer

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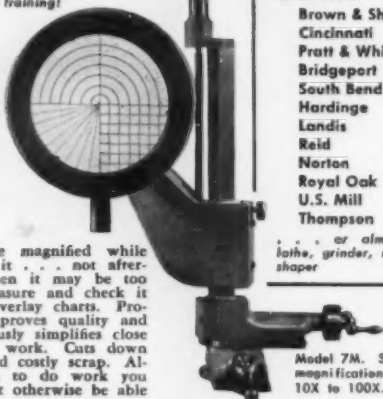
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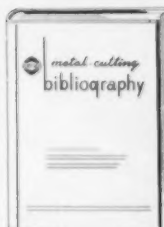
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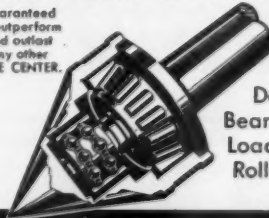
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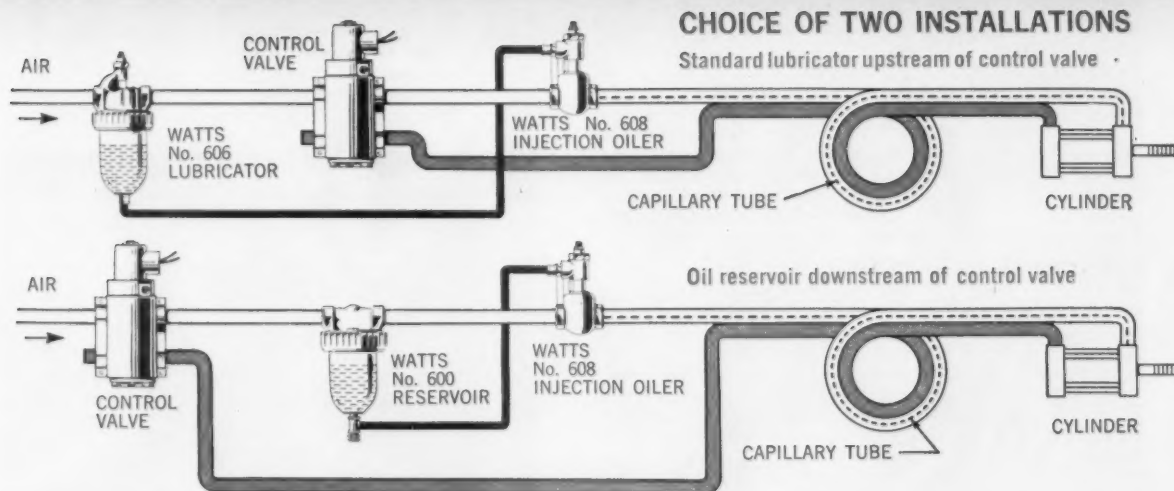
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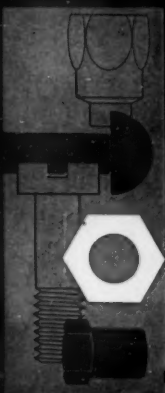
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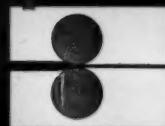
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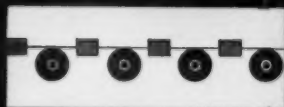
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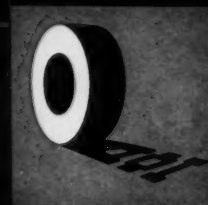


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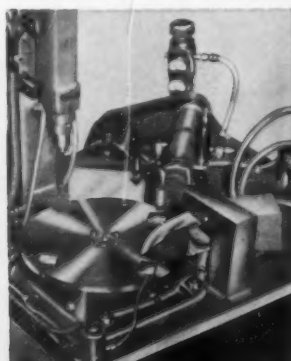
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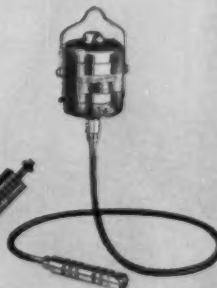


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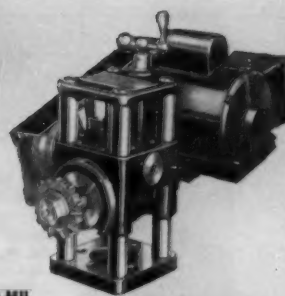
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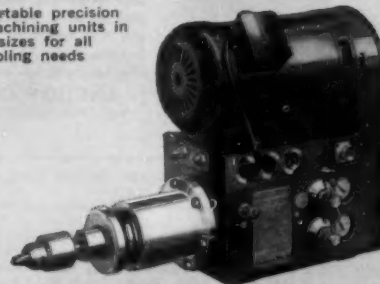
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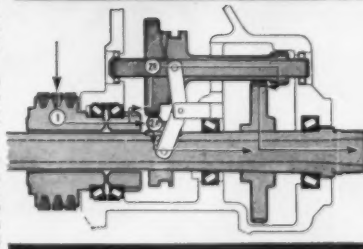
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R. R. 23 Summarizes replies received from a questionnaire sent to the Metal Stamping Committee. Highlights the wide difference of opinion held by authorities. Price .75 (non-member 1.50)
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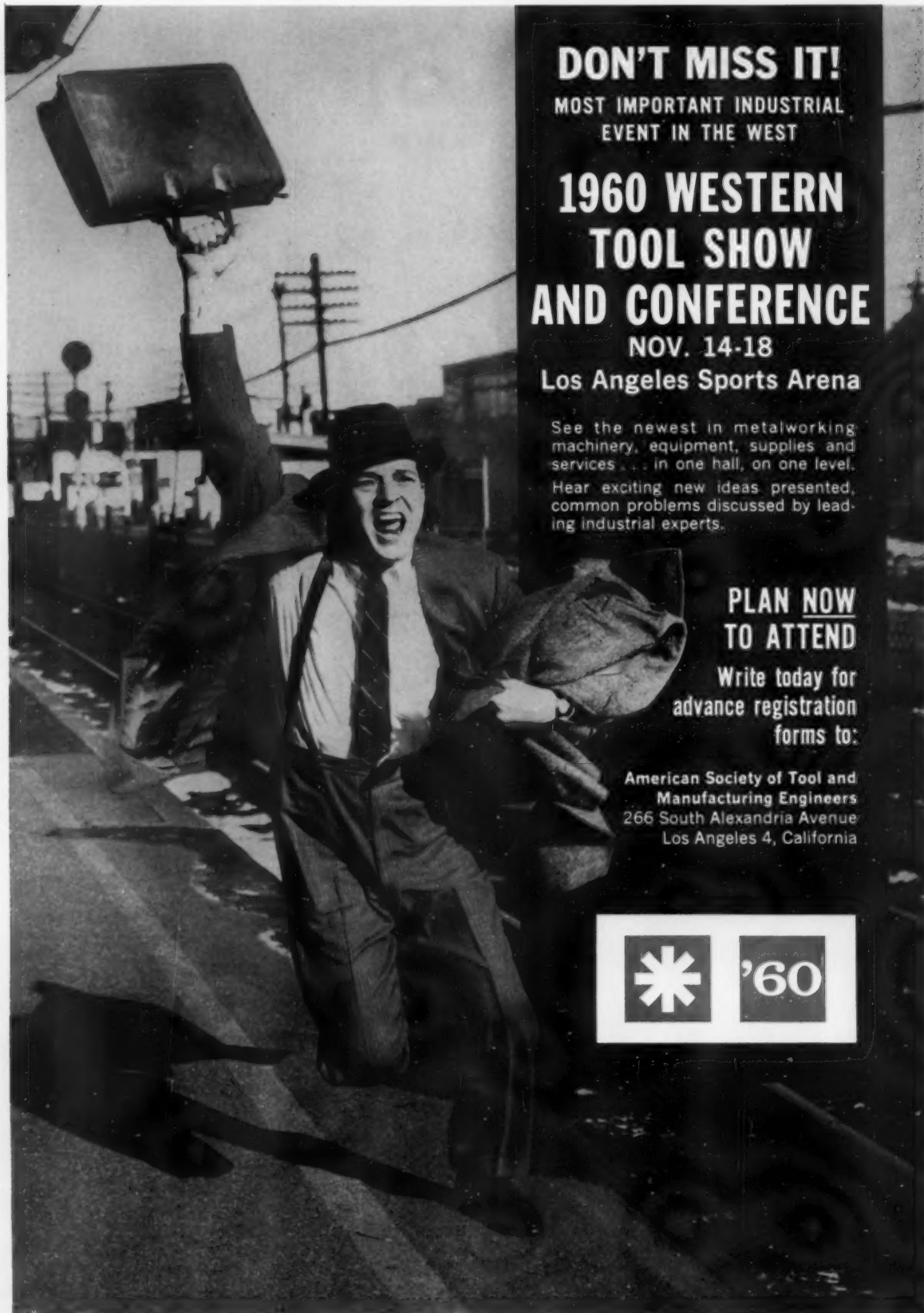
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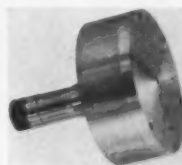
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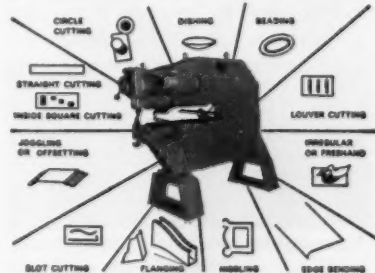
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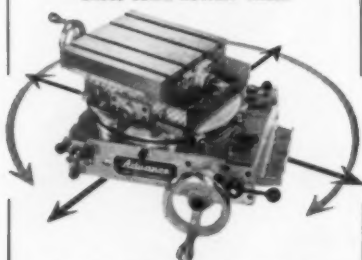
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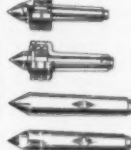
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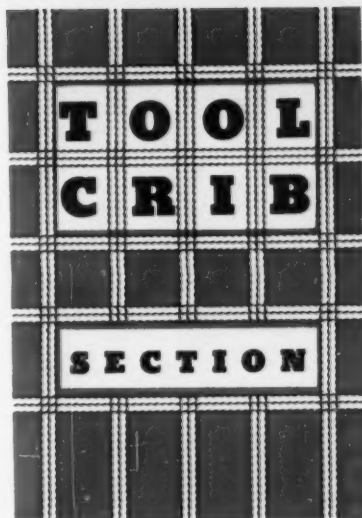
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LOOKING AHEAD

By T. W. Black
Senior Associate
Editor

A six-member Engineers Joint Council delegation to Russia has added critical emphasis to the U.S. engineering enrollment problem (an 11.1 percent decline in 1958, 3.5 percent in 1959). In their survey of the utilization of engineers and engineering technicians in the Soviet Union, the Americans found "technicums" (technical institutes) operating an efficient and effective program. The Soviet, they were told, is producing 250,000 technicum graduates annually for industry; while technical institutes in this country are graduating 14,000 to 16,000 a year—"of whom not over 1000 are of the quality of those produced by the technicums we visited." In addition, Russia is graduating 108,000 engineers annually.

Other findings: A significant change in Soviet engineering education—closer integration with industry—has been made since the last U.S. study by an ASEE (American Society for Engineering Education) team in 1957. Russian graduates can now be effectively utilized by industry immediately after graduation because of the practical work experience obtained at "enterprises" (industrial plants) during the educational process.

Russia's present goal is to admit not more than 20 percent of all high school graduates directly to higher education. The remaining 80 percent have to spend two years in practical work in industry before being allowed to continue their education. Even the 20 percent who are immediately admitted to higher education are required, as part of their curriculum, to spend 16 months in practical work in industry.

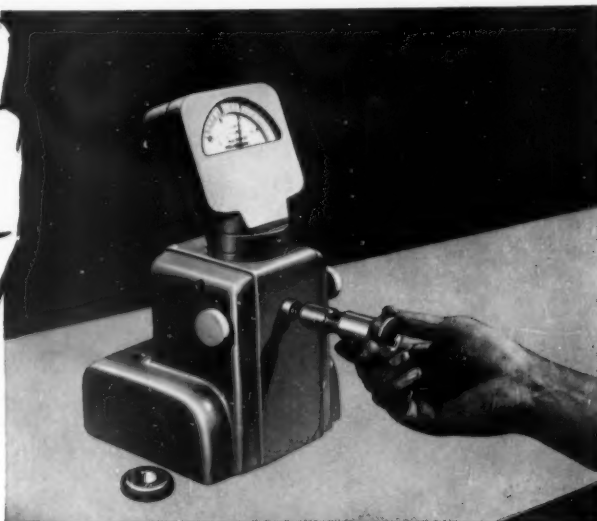
Stipends are given to 75 to 80 percent of all students, based on academic performance. A third of the technicum students are women. The EJC delegation concluded that the theoretical and mathematical content of the courses is above that generally given in bachelor degree programs in U. S. engineering colleges.

This issue of THE TOOL AND MANUFACTURING ENGINEER has been largely devoted to new developments in machine tools and production equipment. The October issue of the magazine will have the usual balanced diet of articles covering all aspects of manufacturing.

Norton Co. research engineer W. R. Backer will discuss the effects of wheel unbalance on high-precision grinding operations. A short article based on Ford Motor Co. operations will show how a grinding wheel testing program has resulted in dramatic decreases in grinding costs.

Other articles will give data on the machining of tungsten, flame spinning, nondestructive testing, short-run band sawing and modern inspection methods. Harry L. Stewart's series of articles on the application of pneumatic power will conclude with Part 3—Automation. And a series of articles on reducing tool and die costs by The Carpenter Steel Co.'s J. S. Pendleton, Jr., will start with an article on how to save time in toolmaking. Articles like these help American engineers stay ahead of their Russian rivals.

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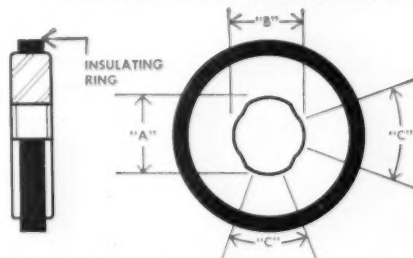
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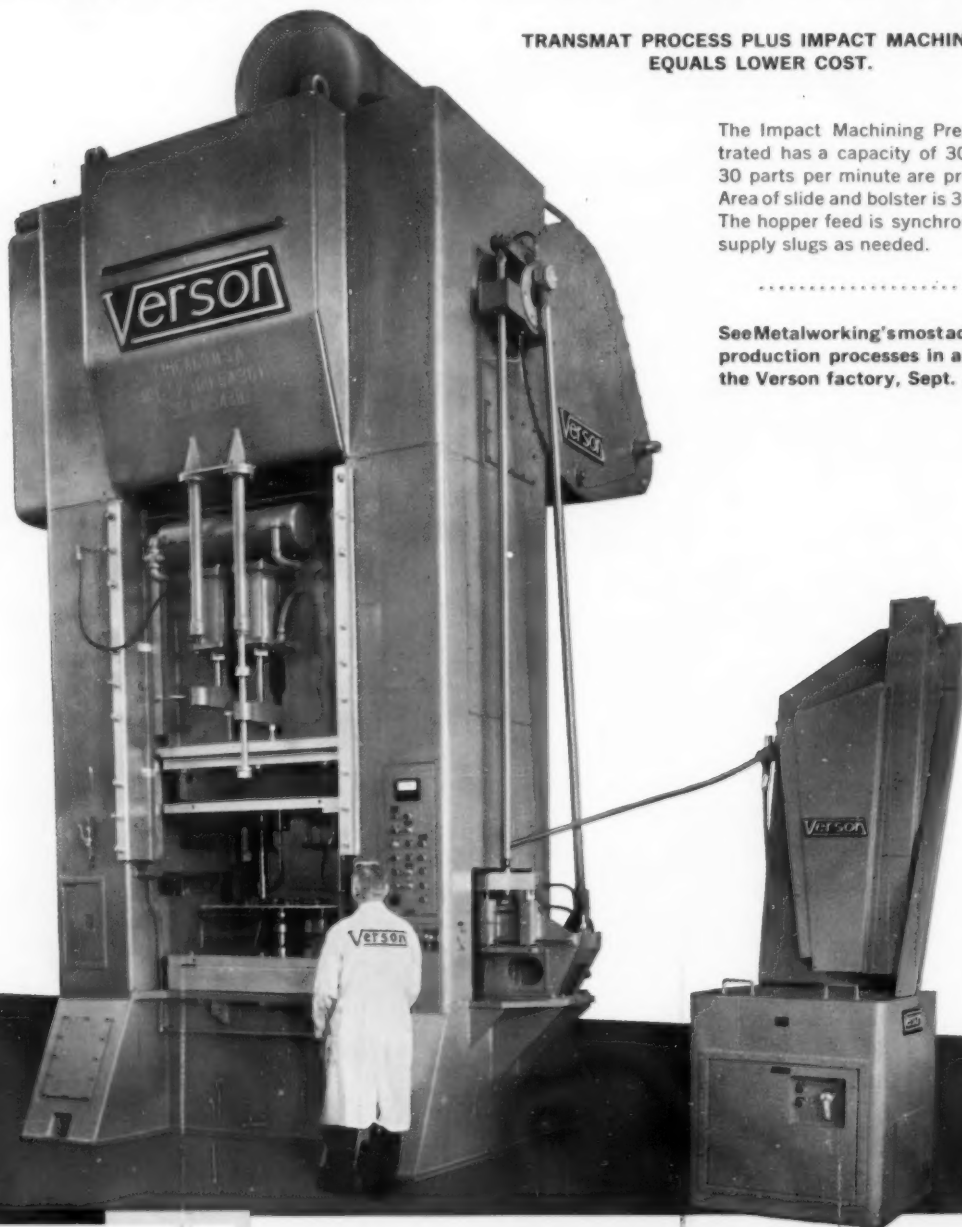
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